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Note

The four articles which follow are, with minor alterations, the English texts of papers read to an Anglo-French Colloquium on the Theory of Economic Growth held in Paris in December 1958 at the invitation of Professor François Perroux, Director of the *Institut de Science Économique Appliquée*. The French texts are to be published by the *Institut*.

MRS. ROBINSON ON SIMPLE ACCUMULATION

A COMMENT WITH ALGEBRA

By G. D. N. WORSWICK

THE main purpose of this paper is to translate into algebra Mrs. Robinson's model of simple accumulation with constant technique, which is described in her book *The Accumulation of Capital* published in 1956. This may seem a perverse thing to do. Mrs. Robinson, it might be said, has taken a great deal of trouble to set out her model in words, and in this way to make her ideas accessible not only to the minority of economists who have mathematical equipment but to the great majority of people who are interested in economic growth but do not have such equipment. The best reason I can give for making this translation is that I was driven to do it because I found myself coming adrift more than once in following her argument. In all her writings Mrs. Robinson has done tremendous service to economics by her rigorous avoidance of unnecessary sophistication, and by her insistence upon calling a spade a spade. Her book, as I see it, is an attempt to present a simple framework of economic theory, stripped of all non-essentials, within which the difficult questions of economic growth can be studied. In the *General Theory* Keynes writes of his own long 'struggle of escape from habitual modes of thought and expression', and it is evident that in *The Accumulation of Capital* Mrs. Robinson also has been striving to examine each successive step in her argument afresh and to resist the continuing pressures of habitual modes of thought and expression. It is a secondary purpose of this paper to suggest that in her present exposition there are still traces of such habitual modes, which turn out to be unnecessary, at any rate for some purposes, and which might well, if left unexposed, be seriously misleading.

It is sometimes thought that the objection to the use of mathematics in economics is that it is too hard. The more serious objection, however, is that it is much too easy. To the mathematician it is the invention and elaboration of operations which provide the interest and excitement. What exactly it is which is being operated upon is a question which a man might never ask and yet be a brilliant and original mathematician. But if our mathematician is also to be an economist, this is the question which must be asked and answered, at any rate if the theory is to have valid application to reality. Unfortunately, it is just this question which is so difficult, and it is fatally easy to leave it unanswered and get on with the

operations, the more so that the statistical historians are busily providing us with more and more 'facts' to try out our theories on.

Let me try to make my point by referring to a piece of the stock-in-trade of growth economics. Consider an economy which is to have two properties: (i) The proportion of income (Y) saved in any period is to be a constant (s), and (ii) the amount of capital (K) is to be a constant multiple (v) of output.

Condition (i) can be written $S = sY$ where S is saving.

Condition (ii) can be written $K = vY$.

Now dK/dt, the rate of change of capital, is investment (I). But $S = I$,

$$\therefore \qquad I = \frac{dK}{dt} = v\frac{dY}{dt} = S = sY$$

or

$$\frac{dY}{dt} = \frac{s}{v}Y.$$

Whence

$$Y = Y_0 e^{(s/v)t}.$$

Add to this little bit of algebra a reference to the 'well-known constancy of the savings/income ratio' and to the alleged constancy of the 'capital/output coefficient' and you have the ingredients of a truly potent brew, which is, I hazard, partly responsible for the air of metaphysical inebriation which surrounds some writings on the economics of growth.

One of the troubles, of course, is whether the statistical 'facts' to which I have referred are (*a*) true, and (*b*) relevant. I would suggest that in both these respects a number of theorists have been over-hasty in assuming that they were. But there is another question. When we write

$$I = \frac{dK}{dt} = S = sY$$

we are implicitly postulating that K is measured in such units that, when differentiated with respect to time, it yields another variable I measured in units which are the *same* as when I is identified with S, which is measured in income units. We are presupposing, that is to say, that we have already solved, or know how to solve, the question of evaluating capital. We are also implicitly saying that, given a way of measuring income (and there are, undoubtedly, many ways of measuring income) there is one and only one way of measuring capital. This is to say, in effect, that we have already solved before we begin *the* problem which has defied economists since the beginning of the science, and to which it is by no means certain that there can be a unique answer at all.

This is not an insuperable objection to operating with those particular variables. If it were required that we had to understand the nature of the concepts which we introduce as variables in equations, if we were

called upon to explain 'what exactly *is* such and such' before we could proceed to mathematical or symbolic operations, then there might never have been any science of any kind. And why should not the economist, when working with capital and income, enjoy the same licence as the physicist when working with atoms, neutrons, temperature, and so on? There are certainly two reasons why the economist ought to be far more cautious about exercising this sort of licence. Firstly, the physicist is, as a rule, much more quickly brought up against the possibility of a definite refutation by the facts: indeed in formulating a theory he often has in mind a particular phenomenon which will give just this opportunity. Try as we will, and I wholly approve those economists who are prepared to submit their theory to the test of fact, we all know that 'testing' in economics rarely gives an unambiguous answer. The second reason for caution is that whereas the outstanding feature of many of the physicists' concepts is their universality (the ideas of heat, or electricity, are the same in Africa as they are in Europe), most of the economist's concepts are contingent upon a social framework, upon historical time, and upon values (it is not the case that a single idea of income can meaningfully be used for U.S.A. and Africa in 1958 and for Ancient Egypt). If therefore an economic theory, or model, can be made to work without introducing undefined, or indefinable, concepts, that seems to me in general an exercise worth doing.

The Model of Simple Accumulation

Mrs. Robinson's summary of her argument is very concisely stated in her own words as follows:[1]

> In any economy with only one technique, and no consumption out of profits, when the supply of labour adapts itself to demand, starting from any given situation (produced by past history) the future rate of accumulation is limited:
>
> (1) By the technical surplus available above subsistence level for the workers employed.
>
> (2) Within that limit, it is limited by the surplus above the level of real wages that the workers are willing to accept and able to enforce (by creating an inflation barrier against a fall in real wages).
>
> (3) Within that limit, accumulation is limited by the energy with which entrepreneurs carry it out.
>
> (4) When the size of the labour force is independent of the entrepreneurs' demand for workers, a maximum is set to the possible rate of accumulation by the rate of increase of the labour force. When accumulation fails to reach this rate there is growth of long period unemployment.

The basic components of this model, as we shall see, are physical in concept, but Mrs. Robinson brings into her account of the process more sophisticated economic concepts such as capital, rates of profit, inflation, and entrepreneurial energy. All these, no doubt, may ultimately need to be

[1] *The Accumulation of Capital*, pp. 83–84.

incorporated in a complete *theory* of the spontaneous growth of an economy under 'free enterprise'. For reasons which will be apparent later, I propose to do without them. The economy, I shall imagine, is run by an all-powerful dictator, who has started a 'machine economy' inside a stockade.

Inside the stockade, besides the dictator, are machines and workers. The machines, manned by the appropriate number of workers, produce a homogeneous consumption good, which is the sole item of consumption of the workers. The dictator arranges things, and in the first instance lives on air. Outside the stockade live an indefinite number of potential workers who also live on air, or more specifically find their living without being in any economic relation with the 'machine economy' inside the stockade. These outside people are, however, always willing to come to live and work inside the stockade when summoned by the dictator. They all receive the same 'wages' which consist of amounts of the consumption good produced by the machines.

I shall start by setting up two formal models, using symbols. They are both, I think, consistent with Mrs. Robinson's theory—or rather nothing in either of them is specifically ruled out by anything I have been able to find in her book. The difference between them is simply this. In the first one the homogeneous consumption good is made by machines, with the appropriate amount of labour per machine: but the machines themselves are made by hand. In the second model the machines can be used either to make consumption goods (with appropriate amounts of labour) *or* to make other machines (with appropriate amounts of labour). This dual purpose function of machines, to make goods or to make themselves, looks odd at first sight but on close inspection is seen to be an essential alternative to the first case. If one looks for examples one simply has to think of hammers, or chisels, or, taking a wider view of 'capital', seed-corn, which can be either eaten or used to grow more corn. If we consider these two extreme cases, the more sophisticated cases of machines to make machines to make goods can be treated as some combination of the two extremes.

Model 1. Machines made by hand

There are two strictly *technical* relationships:

(i) Each machine requires a team of n men to co-operate with it, to produce an output of nc consumption goods per annum, where c is output per man-year.

Note the units: machines are measured in—machines. Labour is homogeneous and can conveniently be measured in numbers of men. The question whether or not we could permit less than n, or more than n (e.g. by shift work) to co-operate with a machine is one which we should have

to answer in any development of the model, but it is outside our present purpose. Consumption goods are like treacle, homogeneous, and are measured therefore in physical units of the good.

(ii) m men working normal hours for a year will produce 1 machine.

Suppose the dictator inherits an initial stock of M_0 machines at 1 January, year 0. 'The amount of employment is governed by the stock of equipment in existence', says Mrs. Robinson (p. 73). Let us take this quite literally. M_0 machines will permit the dictator to create employment of $M_0 n$ in the consumption goods sector and thus produce output $M_0 nc$. All we need now is the level of real wages. Since the only thing the workers consume is the consumption good, we can conveniently take real wages per man-year as αc where $\alpha < 1$. At the moment we simply take α as 'given': we shall return to what determines it.

It follows that in a year $M_0 nc(1-\alpha)$ consumption goods will be available to 'feed' workers in the 'investment' sector to produce machines. Employment in that sector can then be $\frac{M_0 nc(1-\alpha)}{\alpha c} = \frac{M_0 n(1-\alpha)}{\alpha}$. This is of course on the assumption that 'real wages' are the same in both sectors.

Thus total employment $E = E_c + E_I$

$$= M_0 n + M_0 n\left(\frac{1-\alpha}{\alpha}\right)$$

$$= \frac{M_0 n}{\alpha}.$$

The number of machines the investment workers will produce in a year is

$$\frac{E_I}{m} = \frac{M_0 n}{m\alpha}(1-\alpha).$$

Suppose the rate of depreciation is a fraction d of the stock of equipment in existence at the beginning of the year. (The machines are inherited from history all nicely arranged in order of age, so that we have no 'lumps' of investment and no 'echo' effects.) Then the stock of machines at 1 January of year 1 will be $M_0\left(1+\frac{n}{m\alpha}(1-\alpha)-d\right)$.

We are not obliged to assume $\frac{n}{m\alpha}(1-\alpha) > d$: we *could* examine the case of a system running down *via* net disinvestment. But in order to disinvest there must have been prior investment at some earlier date, so we shall not pursue this red herring.

M_1 is then $= M_0\left(1+\frac{n}{m\alpha}(1-\alpha)-d\right)$

$$= M_0(1+\gamma) \text{ where } \gamma = \frac{n}{m\alpha}(1-\alpha)-d > 0.$$

If we now repeat the story and work out how much employment M_1 machines will give, it is clear that E_1, total employment in year 1, will be $= E_0(1+\gamma)$. The proportions of employment between the sectors will be constant. Thus, so long as our dictator can do the necessary elementary algebra to ensure that all the equipment in existence is used to the right (technically right) extent, we get steady growth at the rate of increase of γ per annum where $\gamma = \frac{n}{m\alpha}(1-\alpha)-d$. γ is greater the greater is n, the number of workers required to co-operate with 1 machine in producing consumer goods. γ is less the greater is α (the level of real wages), or m, the number of men required to produce 1 machine, or d, the rate of depreciation. All of which is in accordance with common sense.

Model 2. Machines made by machine

In the second model we suppose that besides being needed to make consumption goods machines are also needed to make machines. We can retain the same notation for the consumption sector, i.e. n men are required to man 1 machine. We now have, however, to introduce two new coefficients. First, for effective use we assume that l men are required to man one machine when it is used in the investment sector.

1 machine$+n$ men produce in one year output cn in the consumption sector (as before).

1 machine$+l$ men produce hl machines in one year, i.e. output per man in investment is h machines per annum.

Once more we start with an initial stock of M_0 machines. But now we have the problem how to allocate them between the two sectors, and this, it will be quickly seen, can be done in only one way. Let ${}_cM_0$, ${}_IM_0$ be the division between the two sectors, consumption and investment.

Then *employment* in the two sectors will be respectively ${}_cM_0 \times n$ and ${}_IM_0 \times l$.

But we also have that the ratio of employment in investment to employment in consumption is $\frac{1-\alpha}{\alpha}$ where α is the ratio of real wages per man-year to output per man-year in the consumption sector (c). (This assumes real wages to be the same in both sectors.)

Hence
$$\frac{{}_IM_0\, l}{{}_cM_0\, n} = \frac{1-\alpha}{\alpha}.$$

Now
$${}_cM_0 = M_0 - {}_IM_0.$$

$\therefore$
$$\frac{{}_IM_0}{M_0 - {}_IM_0} = \frac{n}{l}\left(\frac{1-\alpha}{\alpha}\right).$$

Whence $$ {}_1M_0 = \frac{\frac{n}{l}\left(\frac{1-\alpha}{\alpha}\right)M_0}{1+\frac{n}{l}\left(\frac{1-\alpha}{\alpha}\right)}. $$

The *output* in one year of ${}_1M_0$ machines, properly manned, is

$$ \frac{hn\left(\frac{1-\alpha}{\alpha}\right)}{1+\frac{n}{l}\left(\frac{1-\alpha}{\alpha}\right)} M_0 \text{ machines.} $$

M_1 the stock of machines at the end of the year is thus:

$$ M_0\left(1+\frac{hn\left(\frac{1-\alpha}{\alpha}\right)}{1+\frac{n}{l}\left(\frac{1-\alpha}{\alpha}\right)}-d\right) \quad \text{where } d \text{ is the rate of depreciation,} $$

$$ = M_0(1+\gamma') $$

where $$ \gamma' = \left(\frac{hn\left(\frac{1-\alpha}{\alpha}\right)}{1+\frac{n}{l}\left(\frac{1-\alpha}{\alpha}\right)}-d\right). $$

Leaving aside d, the size of γ' depends on the first term which we can rewrite:

$$ hl\left(1-\frac{1}{1+\frac{n}{l}\left(\frac{1-\alpha}{\alpha}\right)}\right). $$

This is greater as:

(1) h (output of machines per man) is greater.
(2) n (number of men per machines in consumption) is greater.
(3) l (number of men per machine in investment) is greater (this is more easily seen by looking at the first form of γ').
(4) α is smaller.

All of which is in accordance with common sense. (3) looks as though there might be a puzzle. Growth is faster the *more* men are employed per machine in investment, but it must be remembered that we are postulating a constant output per *man* in machine making.

This raises the question what we mean by a given *technique* when machines can produce both consumer goods and other machines. If we require that a change in technique which alters n also alters l in the same proportion (t), then, since these two factors appear in γ' as a *ratio* in the denominator, we find that such technical change would alter the growth rate in the same proportion t.

This result is in line with Model 1, where machines are made by hand, where an increase in n increased γ in the same proportion. But in that

model there was nothing to suggest that an increase in n ought in any way to be associated with an increase in m, the number of men required to make a machine.

It seems to me that there is nothing to require us, under Model 2, to postulate that a change in n must be accompanied by an equi-proportionate change in l. But we should notice that if we do not postulate this, we are in trouble with the definition of a technique, and of a change in technique.

The Significance of the Models

Both these models yield a time path of the economy very similar to that of the simple Harrod–Domar model quoted earlier. (In my illustration of that model I used the differential equation approach. If instead one uses difference equations, e.g. $S_t = sY_t$; $I_t = v(Y_t - Y_{t-1})$: we obtain $Y_t = Y_0 g^t$ where $g = \frac{c}{c-s}$ which is identical in form to the two Models above.)

But there is a subtle difference. In the Harrod–Domar treatment s is usually defined as a savings ratio. In both our models we have something like this for the *consumption sector*, i.e. $1-\alpha$. As to v in the Harrod–Domar model, if we started off from

$$K_t = vY_t \quad \text{and} \quad I_t = K_t - K_{t-1} = v(Y_t - Y_{t-1}),$$

we could call v a capital/output, or capital/income coefficient, with the implication that capital and output (or income) are commensurate. If we start directly from $I_t = v(Y_t - Y_{t-1})$, we may *call* v an acceleration coefficient, but we still require that I and Y should be commensurate. In our models this is not required. 'Capital' and 'investment' are measured in machines: consumption is measured in consumption goods. There is, indeed, a technical relation that a machine, manned by so many men, will produce so many consumption goods. But the advantage here is that there is no possible ambiguity about this relation.

Let us compare the results of our 'dictator' models with Mrs. Robinson's conclusions. The rate of accumulation, she says, is limited:

> (1) By the technical surplus available above subsistence level for the workers employed.
>
> (2) Within that limit, it is limited by the surplus above the level of real wages that the workers are willing to accept and able to enforce (by creating an inflation barrier against a fall in real wages).

In both our models, given all the other technical conditions, the rate of growth depends on α, the ratio between wages and output per man in the consumption sector, and is greater, the smaller is α. We did not discuss how α was determined. Clearly, if the wage is below subsistence,

the system would ultimately stop through starvation of workers. Or alternatively, we could postulate that people will not enter the dictator's stockade for a wage less than 'subsistence'.

As for the second condition, we can envisage some 'negotiation' between the dictator and the workers to decide what α should be. I see what Mrs. Robinson has in mind when she talks of an 'inflation barrier'. Her model is one of a simplified enterprise system, and a resistance to reductions in real wages is certainly *one* of the possible explanatory factors of actual inflations in actual enterprise economies. But it is not the only factor: moreover, actual inflations can occur when real wages are *rising*. The analysis of actual inflations is proving to be formidably complex (to judge from contemporary discussion in Britain and U.S.A., for example): it might therefore be wiser not to introduce such a sophisticated notion, but simply to say that if, somehow or other, the workers can secure a real wage above the subsistence level, this puts a further limit to the rate of accumulation.

Returning to Mrs. Robinson's conclusions, accumulation is further limited:

(3) By the energy with which entrepreneurs carry it out.

What exactly does 'entrepreneurial energy' mean? In Mrs. Robinson's exposition the entrepreneurs, and in my models the dictator, live on air, i.e. their consumption is zero. It is an obvious extension of both models to introduce entrepreneurial, or dictator's, consumption. Thus, in my model, the dictator first appropriates the whole technical surplus of consumption goods, and then decides how much to consume himself (or to give to his entourage) and how much to use to pay wages of workers in investment. If he uses the whole surplus for consumption there is no growth, and equally obviously the rate of growth is greater the smaller the proportion of the technical surplus he retains for his, and his courtiers', consumption. Exactly the same argument applies for Mrs. Robinson's entrepreneurs. She does indeed introduce entrepreneurs' consumption later in the book, but there is a case for saying that this factor should be introduced into the *simplest* of models, since it is one of the major factors which has accompanied economic growth in the past and may be needed in the future. If princes cease to build palaces and build dams and factories instead, the economy can start to grow.[1] If energy simply means willingness to forgo consumption, then the rate of growth clearly depends upon it.

But from the context Mrs. Robinson clearly has something else in mind.

[1] In a certain sense France was 'growing' throughout the years of constructing the palaces of Versailles and elsewhere. But the services subsequently rendered by these capital installations were confined to a tiny minority of the population.

Is there any sense in which we could say that our dictator could show energy or the lack of it? At first sight it seems hard to do so. His sole function is, once a year, to solve a simple simultaneous equation from which he deduces the number of workers to summon, and the division of the workers and the machines. The workers do the rest.

Suppose that he gets tired even of doing a simple sum once a year and calls in the wrong number of workers. If it is too large some workers will simply find no place to work and have to go away: if it is too small some machines will simply not be manned. This, it is true, will slow down the rate of growth. On the other hand, it does seem a trifle exaggerated to describe the willingness or otherwise to solve such a simple pair of equations in terms of being 'energetic'.

There is, however, another possibility. Suppose that the supervision of production calls for some effort on the part of the dictator. Then, as the economy grows, the call on his personal time and effort is increased. In this case *either* we allow him to pay supervisory workers, in which case the energy problem is solved for him: *or* we suppose that he cannot do this, in which case he simply refuses to let the economy grow beyond a certain size. Suppose the economy has just reached this point. Its actual output of consumption goods in the following year would be sufficient to lead to further growth. But of the technical surplus he now needs to set aside only just sufficient to pay workers to man machines for replacement, and simply throws away the rest. Or else, if he is in generous mood, he raises α, the real wage ratio, to the level which just leaves enough technical surplus for replacement.

With a single dictator, whose capacity for supervision is limited, the economy must ultimately stop growing altogether. In an enterprise system, however, the problem is how fast, through time, the supply of entrepreneurs (of a given supervisory capacity) can be increased. If it is fixed, we have the dictator case. If it increases in proportion $(1+e)$ per annum, then the rate of growth cannot exceed e. If α, the real wage ratio, were such as to yield a $\gamma > e$, then sooner or later the system will break down, not from failure to solve an equation, but because each entrepreneur begins to leave machines idle out of sheer inability (or unwillingness) to manage them. If they are intelligent men and understand what is happening to the economy, they may simply raise α so that the new and lower γ is equal to e. We might link this up with the problem of the determination of α, the real wage ratio, of which we have said little so far. Given α, then that determines how much 'energy' will be called for from the dictator (or the entrepreneurs) this year and in all subsequent years. Alternatively, given the amount of 'energy' the dictator (or entrepreneurs) are prepared to expend this year, and given the rate at which the supply of 'entre-

preneurs' can be increased (or the dictator can find assistants), that determines the level of α which will ensure full utilization of initial and subsequent equipment.

There is certainly sense in this. There is no point in curtailing consumption (increasing the propensity to save) if neither a dictator (or the State) nor the entrepreneurs can be found to invest and to supervise production. We should stress, perhaps, that the entrepreneurship function envisaged here is essentially one of arranging and managing. The question of risk does not arise in this model.

It is in the above sense, I believe, that we should interpret Mrs. Robinson's concept of the 'entrepreneur's demand for workers' if we wish to mean by that expression something more than the number of machines they have, multiplied by the appropriate n or l (number of workers per machine) coefficient.

Mrs. Robinson's final conclusion was:

(4) When the size of the labour force is independent of the entrepreneurs' demand for labour, a maximum is set to the possible rate of accumulation by the rate of increase of the labour force. When accumulation fails to reach this rate there is growth of long period unemployment.

In our examples, employment *inside* the stockade was assumed to rise at rate γ, it being first assumed that there was an indefinite supply of potential workers *outside* the stockade. If we now consider the whole labour force of the 'country' to include the stockade and the hinterland, this conclusion is almost intuitively obvious, but I set out a formal proof in the appendix. The second sentence makes one wonder, however, whether it is always wise to talk in terms of 'countries' and 'economies'. Growing long-period unemployment has occurred and could conceivably occur again in mature industrial countries. But the case which springs to mind from a study of Mrs. Robinson's model is rather that of a country like India, say, in which industrial investment, and employment, is growing, but not as fast as the total population of working age. In my terminology the stockade economy is growing, but not fast enough to absorb the growth of population in the hinterland. One might argue that formally the mature country case and the under-developed country case are the same: this is in the sense that all countries are always underdeveloped. But I have a suspicion that the formal similarity may cover up significantly different economic and social causes. For the mature country case may well be accompanied by a simultaneous appearance of idle productive capacity (this was certainly so in the nineteen-thirties), whereas in the Indian case it is the failure of capacity to come into existence fast enough which is the trouble. In terms of a symbolic algebra these may seem the same but economically they are not and it might be

better in the theory of the latter case to work always with a two-sector model, e.g. the stockade and the hinterland, and to avoid unitary statements applying to the whole country or economy.

The Problem of Profits

In Model 1 the idea of 'profit' in the consumption sector does not at first sight present any difficulties. It is the difference between the output of the machines (operated by the requisite number of workers) and what has to be paid to the workers. Profit is a surplus, which arises out of the *technical* character of production. And this surplus is sufficient to pay the wages of the workers in the investment sector who produce new machines (I am here assuming that there is zero depreciation). We *could* value the machines, it would seem, in terms of the amount of labour required to produce them, multiplied by the real wage rate. Since it requires m men to produce 1 machine in a year, and the real wage per man is αc, the value, or cost, of 1 machine could be put at $m\alpha c$. This looks straightforward enough. The trouble is that if we do it, there is no 'profit' at all in the investment sector. Thus Mrs. Robinson's remark that 'a uniform rate of profit is established throughout the system' is a bit premature; for in the investment sector there is no profit and no capital. Of course $\frac{0}{0}$ can be made into whatever we like, but that is not a very helpful suggestion.

Another approach is to put *prices* on consumption goods and machines and see what happens. Let p be price per unit of consumption goods and s the price per machine.

Then value of output in the consumption sector is $M_0 ncp$. The wage bill is $M_0 ncp\alpha$ (when the real wage ratio is α). Profit (in money) $= M_0 ncp(1-\alpha)$. Employment in the investment sector, it will be remembered, was $M_0 n\left(\frac{1-\alpha}{\alpha}\right)$ and it produced $M_0 n\left(\frac{1-\alpha}{\alpha}\right) \times \frac{1}{m}$ machines. Thus, money value of machine output is $\frac{M_0 ns}{m}\left(\frac{1-\alpha}{\alpha}\right)$ and the money wage bill in this sector is $M_0 n\left(\frac{1-\alpha}{\alpha}\right) c\alpha p$. Money profit in this sector is now

$$\left[M_0 ns\left(\frac{1-\alpha}{\alpha}\right) - M_0 ncp(1-\alpha)\right].$$

The profits in the consumption sector are no longer sufficient to pay for the new output of machines, but total money profits of both sectors still just suffice. That is to say, if we choose a quite arbitrary s, we still get just the right amount of total money profit to buy the new machines, so if we imagine the consumption entrepreneurs borrowing the profits from the investment entrepreneurs (and after all the latter have no *use* for their

profits, since by definition they do not consume and do not need machines) all will be well.

But this does not really get us anywhere because since, by definition, there is no 'capital' (i.e. stock of machines) in the investment sector it would give us an infinite rate of profit in that sector and we should be no nearer to equal rates throughout the system.[1]

Does Model 2 help us at all with the question of the rate of profit? In one respect it must, for we now have machines (capital) in both sectors, so that there will be no necessary embarrassment of an infinite rate of profit in one sector. It still remains true that if we choose arbitrary *prices* for machines and consumer goods and allow inter-borrowing between the sectors, we can once more show that the profits of the system are sufficient to finance investment.

But there is a procedure, which I owe to Professor Kahn, which will yield a non-arbitrary solution. We introduce two new variables, K, the initial 'cost' of a machine, and r, the 'rate of profit'. The machine is assumed to last for ever, so that the return on initial cost is Kr.

The cost of production of one machine is then $\frac{Kr+lc\alpha}{hl}$ and this must be equal to K.

Hence
$$K = \frac{l\alpha}{hl-r}c. \tag{i}$$

Looking at the consumption sector we have that the profit per machine is Kr and this must equal $nc(1-\alpha)$ or

$$K = \frac{nc(1-\alpha)}{r}. \tag{ii}$$

From (i) and (ii):
$$r = \frac{hn\left(\frac{1-\alpha}{\alpha}\right)}{1+\frac{n}{l}\left(\frac{1-\alpha}{\alpha}\right)}$$

and
$$K = \frac{\alpha c}{h}\left[1+\frac{n}{l}\left(\frac{1-\alpha}{\alpha}\right)\right].$$

r is seen to be equal to γ', the rate of growth of the system, in the case where machines last for ever.

The above is algebra. It is worth stressing two economic aspects of the procedure. (i) We have *assumed* the rate of profit to be the same in the two sectors, and (ii) in calculating the 'cost of production' of the machine we have used r as the rate of interest to be applied to K in order to get the capital cost component. In other words, in the case of an entrepreneurial system we have introduced something akin to Mrs. Robinson's

[1] *The Accumulation of Capital*, p. 74.

'golden age' assumption. We should, however, emphasize that the introduction of K and r was in no way necessary to obtain the results which show how in a dictator system the rate of growth is related to the technical conditions and to α, the real wage ratio.

Conclusion

This paper might, at first sight, appear to be a sustained attack on Mrs. Robinson's theory of accumulation with one technique. This is certainly not its intention. My purpose has been wholly to restate the model without using any concepts which do not appear to me absolutely essential to its description. The main difference in presentation is the introduction of the planning dictator. The conclusions which are reached are, with one or two minor queries, those which Mrs. Robinson had already reached. I think my own exposition brings out certain essential points more clearly, and I know that some of my students have found this as well. In itself this is not remarkable. We all know that the best approach to Ricardo or Keynes is not to read their original work. But we cannot ignore the fact that Mrs. Robinson has created an enviable reputation as one of the most lucid writers of economic theory who has ever lived, and one, moreover, who consistently shuns the mysterious and the metaphysical. I am tempted to think that more may lie behind the resort of choosing a dictator to arrange the economy than a mere trick of presentation.

I should first emphasize that the presentation is made at a very high level of abstraction and this should warn us against plunging rashly into real economics. Nevertheless, the desire to say something about reality can never wholly be resisted. The dictator models are suggestive of the state of affairs in a hitherto undeveloped country when some national 'authority', be it a prince or an elected government, deliberately sets out to make the economy grow. The question then is: Given certain technical relations, what are the growth possibilities? What determines the rate of growth which can be achieved, and what are the kinds of things the authority must do to secure that rate of growth? In our instance we have indicated how the possible growth rate depends, among other things, on (i) the technical factors themselves, (ii) the real wage ratio, and (iii) the consumption of the dictator's entourage. We have also indicated what the dictator must do: specifically we told him how much labour to employ and how to divide his labour and machines between the consumption and investment sectors. The system can only 'break down' if the dictator goes mad.

The situation with an enterprise model is different. We can, of course, ascertain, as with the dictator case, what rates of growth are technically

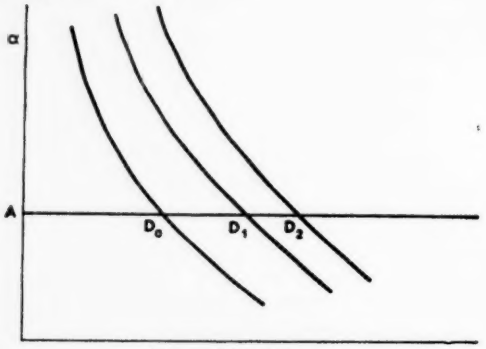
possible. We can also say how the labour force and machine stock must, somehow or other, be divided. But now a new problem obtrudes, namely, will the enterprise economy *in fact* achieve this rate of growth and, further, will it grow steadily at all, or be subject to fluctuations or instability? To deal with these questions we have to set up some model of the behaviour of the *individual* entrepreneur (as distinct from the whole economy) so that we can study the mechanism of the interaction between the individual entrepreneurs. Until a few years ago, the whole emphasis in the construction of such entrepreneurial systems was given to the explanation of unemployment and, above all, fluctuations. In so far as the *trend* has received more attention recently, this seems to be an advance. After all, without committing oneself to the view that there *is*, in some ultimate sense, an intrinsic cyclical character in enterprise systems, there have been quite obvious fluctuations in actual enterprise economies in the nineteenth and twentieth centuries. There has also been growth. But there has rarely been *steady* growth. Now it would seem sensible to try to construct models which fit, roughly no doubt, the actual events of the past and then to go a stage further and ask, what restrictions would have to be imposed upon the behaviour of individual entrepreneurs, or what counteraction would have to be taken by a 'dictator' (or central government) to secure steady growth of the economy, notwithstanding its observed tendency to have unsteady growth in the past.

But if one's purpose is to expose the aggregative *conditions* of steady growth, one is bound to ask whether it is necessary, or wise, to introduce the entrepreneurial system. Mrs. Robinson is obliged to postulate a 'golden age', which is not only highly artificial but also somewhat metaphysical in the same way as Harrod's 'warranted rate of growth'. These concepts, it seems to me, reduce the entrepreneur to such a shadow of his real substance that we wonder whether he is needed at all. Formally, such procedures are defensible: though I have to admit that I myself find them difficult to handle. But the terms in which they are expressed encourage (or do not sufficiently discourage) the transition from the simple abstraction to complex reality. Witness the extraordinary concern that the Harrod 'warranted-rate' growth path was unstable. Surely, if it had turned out to be stable that might have been equally alarming. For the fact remains that in the era of *laisser-faire* enterprise systems did not grow steadily but unsteadily.

APPENDIX

A Rising Supply Curve of Labour

In Model 1 (and in 2) we assumed that there was an indefinite supply of labour available at any wage rate αc. The 'demand' for labour in year 0 was simply $\frac{M_0 n}{\alpha}$. In year 1 it would rise to $\frac{M_0 n}{\alpha}(1+\gamma)$, where $\gamma = \frac{n}{m\alpha}(1-\alpha)$. (This is the case of no depreciation.) The demand for labour could, therefore, be represented by a series of rectangular hyperbolae, one for each year, and the abscissae of each being $(1+\gamma)\times$ the abscissa of the year before, at the same wage ratio. (It is convenient to use α, the ratio of real wages/output per man in consumption goods as the variable, rather than αc, the real wage rate.)



Demand for Labour

FIG. 1

In Fig. 1 $$\frac{AD_2}{AD_1} = \frac{AD_1}{AD_0} = 1+\gamma.$$

But we must remember that γ itself is a function of α. In fact, $\gamma = \frac{n}{m}\left(\frac{1}{\alpha}-1\right)$. As α increases γ declines. In the limiting case of $\alpha = 1$, γ falls to zero.

We cannot thus superimpose a supply curve of labour on to Fig. 1. We must proceed by stages. Suppose the supply curve, for convenience, is a rising curve SS'. Let it intersect the D_0D_0' curve corresponding to M_0 machines at P_0. That gives us both the wage ratio α_0 to operate in year 0, and also γ_0, the rate of growth for the first year. Hence, we can construct D_1D_1', corresponding to year 1. α will rise from α_0 to α_1 corresponding to positions P_0 and P_1. γ_1 for year 1 will therefore be less than γ_0, and D_2D_2' will involve a smaller proportionate shift of the demand curve to the right than in the first year.

P will, therefore, limb up SS' but by smaller and smaller amounts as α increases. The system will approach a stationary state, with $\alpha = 1$. The rapidity with which this occurs clearly depends on the elasticity of SS': the less it is the more quickly the system ceases to grow.

In Model 2, $$\gamma' = hl\left(1-\frac{1}{1+(n/l)\{(1/\alpha)-1\}}\right).$$

Once again as α increases γ' falls. When α reaches 1, γ' becomes zero. So the addition of machines to make machines does not alter the picture. With a rising supply curve of labour the system will simply grow more and more slowly until it ceases to grow altogether.

We see here a hint of how technical progress can stave off the stationary state. As α rises γ falls, but, algebraically, the effect of a rise in α from one year to the next can be offset by an appropriate rise in n (in Model 1) or in l and n (in Model 2, remembering our observation about the need to keep n and l proportionate). As α approaches 1 these increases in the number of men per machine, and thus of the

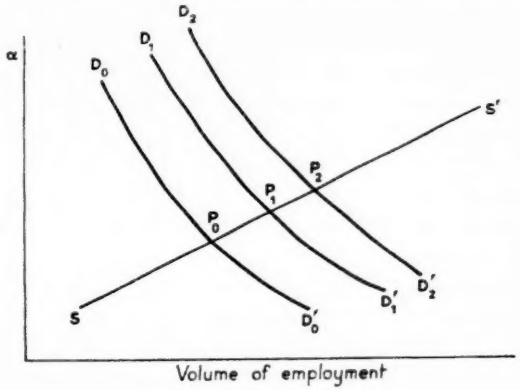


FIG. 2

output per machine, would need to be more and more prodigious. Moreover, while in algebra one can raise the productivity of machines overnight, in real life it takes time, possibly many years, to replace the old machines with the new kind. Meanwhile α will be rising.

In presentations of the Joan Robinson model it is usually stated that growth will continue if the working population grows. The simplest way to give precision to this is to require the supply curve to shift to the right each year in the ratio $1+\gamma$. In this way the real wage ratio α would stay at its original level. We notice that the 'required' rate of growth of the working population r is a function of the initial α, the real wage ratio. If r were $> \gamma$ in the first instance, α would fall and γ rise to come into equality with r. If r were less than γ in the first instance, α would rise and γ fall until it reached equality with r, assuming r to be independent of α.

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A Comment by JOAN ROBINSON

I AM very sorry that my book should be so difficult. What I meant is quite simple, but I evidently failed to make it clear. I certainly do not regard Mr. Worswick's paper as an 'attack'. It is a very useful exploration of one of my basic propositions. But there are two points, one minor and one major, where I find Mr. Worswick unhelpful.

To take the minor point first, why does he make such heavy weather of the case where there are no machines in the investment sector? If there is literally no capital in that sector, employers have no hold over workers and some different economic system would have to be in force. But we can easily see, from the formula that Mr. Worswick uses, that as capital

in that sector becomes vanishingly small, the cost of a machine tends to $c\alpha/h$ (the wage cost of a machine). The quantum of profit in that sector tends to zero (in competitive conditions) though the rate of profit remains at the over-all ruling rate.

The major point is that Mr. Worswick assumes that the wage rate is fixed in terms of treacle (the homogeneous consumption good). This is the kind of simplification that is unhelpful because we shall not know what to do when it is removed. Let the dictator fix the wage in terms of money and sell treacle to the workers, allowing the market to settle the money price of treacle. Now, the gross profit on the sale of treacle is equal to the wage bill of the investment sector. The more men the dictator has set to work on making machines the higher the price of treacle and the lower the treacle-wage.

If he calls so many men to make machines that the treacle-wage falls below the level tolerated inside the stockade, he will be given notice by wage demands (I quite agree that this is not the *only* source of inflation). If he makes it too low to attract workers from outside, he will be brought up short by the scarcity of labour. If he is slack and calls few to make machines, the money demand and therefore the price of treacle is correspondingly low and treacle-wages inside the stockade therefore higher.

Starting from this conception we can go on to break the dictator up into independent private-enterprise firms; we can break the treacle up into various commodities; we can allow for consumption out of profits (which tends to reduce real wages and raise gross profits); we can make the dictator a planning authority which has to adjudicate between the interests of those inside and outside the stockade, and so forth, elaborating the analysis as required. Mr. Worswick's argument seems to be quite correct as far as it goes, but so long as he leaves the dictator stuck in the treacle we cannot get on and his parable has an unnecessarily limited range of illumination.

EXERCISES IN THE ANALYSIS OF GROWTH

By R. F. KAHN

THE development in the last few years of theories of economic growth has introduced new concepts and called on unfamiliar tools. In this lecture I intend no more than to take out for an airing a few of the concepts to which Mrs. Robinson and others have introduced us and to try out the edge of a few of the tools. I am not attempting to build up a theory of growth and still less to arrive at any conclusions.

I will begin with the fundamental identity, based on treating income as divided between capitalists' incomes and wages. At any and every moment of time there is a simple relationship between the rate of growth in the value of the stock of capital and the ratio to that value of the stock of capital of the current incomes of the capitalists. This relationship involves the proportion of capitalists' incomes which is saved and the proportion of wages which is saved. The only other factor which enters into the relationship of identity is the ratio of the value of the stock of capital to the value of output, but this drops out if only a small proportion of wages is saved.[1]

What is necessary for this simple relationship to be generally valid is that *income* should be defined in a suitable manner, so that the excess of income over consumption is the same thing as the rate of change in the

[1] Let α be the proportion saved out of capitalists' incomes and β out of wages.

Then investment = saving
= capitalists' saving + wage-earners' saving
= α (capitalists' incomes) + β (wages)
= α (capitalists' incomes) + β (total income − capitalists' incomes)
= $(\alpha-\beta)$ (capitalists' incomes) + β (value of output).

It follows that the rate of growth of the value of the stock of capital, which is measured by

$$\frac{\text{investment}}{\text{value of stock of capital}},$$

is identically equal to

$$(\alpha-\beta)\frac{\text{capitalists' incomes}}{\text{value of stock of capital}} + \beta\frac{\text{value of output}}{\text{value of stock of capital}}.$$

The form of this relationship was established and used by Mr. Kaldor in his 'Model of Economic Growth' (*Economic Journal*, Dec. 1957, p. 611). It is used by Professor Champernowne in his 'Capital Accumulation and Full Employment' (*Economic Journal*, June 1958, p. 218). As I have reproduced it here it must, however, be regarded for the present purely as an identity.

If $\alpha = 1$ and $\beta = 0$, the rate of growth becomes identically equal to the ratio of capitalists' incomes to the value of capital. This is the simplified form in which Mrs. Robinson had presented the relationship in her *Accumulation of Capital* (p. 76).

value of the stock of capital. This requires that the owner of a piece of capital equipment should include in his income any increase in its value which, after due deduction of depreciation, arises apart from any physical work conducted on it by way of improvement (and that he should deduct any fall in its value apart from depreciation). As a corollary, the relationship, if it is to be valid, requires that any such changes in the value of capital equipment are included in investment, which has to be defined as the rate of change in the value of capital and not in any sense as the value of the change in the amount of capital.

The same kind of relationship could be expressed in terms of alternative definitions of income provided that the rate of growth of the stock of capital was appropriately defined. For example, if we follow ordinary social accounting procedure, investment is measured by the cost of additions to the stock of capital and income does *not* include additions to the value of existing capital equipment which result, say, from a rising price level or from improving profit expectations. For the relationship to hold, the rate of growth would then have to be defined as the rate of expenditure on additions to the stock of capital (less depreciation, with the logical problems therein involved) divided by the value of the stock of capital.

The magnitude of the capitalists' savings coefficient depends on the definition of income which is adopted—unless capitalists do not consume at all, in which case the coefficient is always unity. And the natural choice of definition turns on the extent and manner in which increments in the value of capital influence capitalists' consumption.

This problem of definition is considerably eased if all values are measured in terms of consumption goods rather than money. This convention I will adopt, and when, for example, I speak of 'wage-rates' I shall mean 'real wage-rates'. The implications of an expectation of rising prices are not, however, by this device entirely eliminated and I shall have to return to the problem.

On whatever set of definitions the relationship is based, I have said nothing so far which imbues it with any causal force. It is purely an identity—a glorified version of the identity between savings and investment, which I claim to be a useful instrument for detecting error against those detractors who contemptuously dismiss it as a 'truism' or, more contemptible still, a 'tautology'. Our glorified version of the Keynesian identity would be as consistent, so far as anything emerges from what I have stated so far, with a system of ideas under which the rate of growth of capital was derived from the rate of profit as with a system under which the rate of profit is derived from the rate of growth. Also the identity is valid irrespective of any technical or other conditions—it does not require

that the character of technical progress should conform to any particular pattern, and it is independent of the behaviour of the labour force and of employment and unemployment.

It is to be observed, however, that the relationship is not expressed in terms of the *rate of profit*. It is expressed in terms of the ratio of capitalists' incomes to the value of the stock of capital. It is the *current* incomes of capitalists which enter into the relationship. The rate of profit, on the other hand, if properly defined, is a matter of *expected* capitalists' incomes. At least this is what the rate of profit should signify if the term is used in the context of investment decisions, and in particular if it is regarded as having any correlation of a technical character with the stock of capital.

Let me now take one step forward and inquire what the position is if for some reason or other I can postulate that the rate of growth of capital is constant over a long period of time and that expectations are consistently such as, in the broad, to be realized, so that conditions of long-period equilibrium prevail. It follows from the relationship that if the proportion of wages saved is small, the ratio of capitalists' incomes to the value of capital is constant through time. Such a case is not only consistent with the assumption that capitalists' incomes are *expected* to grow at the same rate as the value of capital, but is highly congenial to the assumption that, in the broad, capitalists' expectations turn out to be justified. Then my postulate results in a rate of profit which is constant through time. And indeed it is only when the rate of profit is constant through time that it can be uniquely defined and unambiguously measured.

So far I have—for fun, as it were, without offering any justification—postulated a constant rate of growth of capital and I have shown that the same conditions which underlie the postulate, whatever they may be, will establish a rate of profit which is also constant. The only other *assumption* is that the two savings coefficients are constant and that for wage-earners the saving coefficient is small. Now I want to take another step forward and make a set of assumptions about technical progress. The assumptions are heroic. I do not make them because I believe in their validity in practice. The reason why I make them is that, for my own part, I desire to learn to walk before I try to run. First of all, I assume that the stage of technical knowledge can at any moment of time be represented by a production function which indicates the technical character of the new plant which it is decided to produce, and the character of its intended utilization. Given the production function, the choice of technique depends on expectations over the prospective lifetime of the plant of the relationship between the price of the particular product and the cost of producing it. With a rate of profit which is constant through time there

is a unique relationship between the rate of profit and the techniques which are being adopted at any moment of time, in the sense of higher rates of profit being associated with lower degrees of mechanization.

In the second place, I assume that the state of technical knowledge at each moment of time, as depicted in the production function, and the development of technical knowledge, as depicted by the movement of the production function through time, are independent factors, and in particular do not depend on the rate of accumulation of capital. In the third place, I assume that the progress through time of technical development is neutral: this means that if the conditions are such as to entail a constant rate of profit the rate of growth of output per head will be the same at earlier stages in the process of production as at later stages; that this condition holds good for every rate of profit within the relevant range; and that this uniform growth of productivity proceeds at the same rate for all rates of profit within the relevant range. All this is entailed in assuming neutral technical progress.

With these assumptions I now want to combine the postulate of a constant rate of profit, entailing a constant rate of gr vth of the value of capital if conditions of long-period equilibrium are assumed, in which expectations are realized in the broad and in particular in which on the average equipment is used in the manner intended. The ratio of the value of capital to the value of output will then be constant through time. And the relative shares of capitalists' and wage-earners' incomes will remain constant.[1]

The magnitude of this constant capital-output ratio will depend on the technical conditions of production, whereas the relationship between the rate of profit and the rate of growth of capital depends only on the savings coefficients. For any given technique, the capital-output ratio depends on the relative prices of capital-goods and consumption-goods. This depends on the wage-rate and the rate of profit, in the sense that a higher wage-rate by itself results in a higher capital-output ratio and a lower rate of profit by itself in a lower ratio. Which effect is the stronger depends on the time pattern of the application of labour in the productive process.[2] The result of technical substitutibility between capital and

[1] Since the ratio of the value of output to the value of capital is constant, the relationship which establishes consistency between a constant rate of growth of capital and a constant rate of profit no longer turns on β, the proportion saved out of wages, being small.

The relationship can also be expressed in terms of the share of capitalists' incomes in total income and the share of investment in output, as has been done by Mr. Kaldor ('L'évolution capitaliste à la lumière de l'économie Keynésienne', *Économie Appliquée*, p. 268; also *Review of Economic Studies*, vol. xxiii, no. 2, p. 95). If the rate of growth of the value of capital is constant and the capital-output ratio is constant, then the share of investment in output is constant.

[2] See I. M. D. Little, 'Classical Growth', *Oxford Economic Papers*, June 1957, pp. 158 and 175.

labour is, taken by itself, that a lower rate of profit means a higher capital-output ratio—the greater the technical substitutibility (the wider the choice of technique at a given stage of technical development) the stronger this tendency will be.

Given the rate of profit, the wage-rate, which plays a part in determining the capital-output ratio, depends on the magnitude of the capital-output ratio and on the value of output per head. The fact that these various magnitudes depend on one another does not mean that the equation involved will not provide a solution. What it does mean is that the wage-rate, and the distribution of income, are related to the technical characteristics of the productive processes, as well as to the rate of growth and the savings coefficients—to which alone the rate of profit is related.[1] Even therefore when the rate of growth can be isolated as an independent factor —a matter which I shall have to deal with—it is only the rate of profit which can be imputed solely to it and to the savings coefficients. If we are interested in how wages and the distribution of income are determined, the technical conditions have to be brought in.

One statement that it is, however, possible to make about a state of constant growth with neutral technical progress is that the distribution of income remains constant through time.

A further such statement is that output per man employed, and the wage-rate, both grow at a rate equal to the rate of technical progress, irrespective of the rate of growth of capital. On the other hand, the aggregate of real wages grows with aggregate output at a rate equal to the rate of growth of capital.

The reconciliation lies in the behaviour of employment. This increases at a rate equal to the excess of the rate of growth of capital over the rate of technical progress. If the two are equal, employment remains constant. If the rate of technical progress exceeds the rate of growth of capital, employment diminishes.

I have said nothing so far about the labour force or, as I shall put it, population. The relation between the behaviour of employment and the behaviour of population determines the behaviour of unemployment.[2] I therefore make a further assumption. I assume that if population changes at all it grows (or diminishes) at a constant rate. And to match this assumption I assume also that the rate of technical progress is constant.

Then if the rate of growth of capital is equal to the rate of technical progress *plus* the rate of growth of population, the proportion of unem-

[1] If the wage-earners' savings coefficient is small.

[2] For the sake of simplicity, I assume that the unemployed subsist at the expense of the standard of living of those who are employed.

ployment will remain constant. If at any stage there is full employment, there is full employment continuously.

I have now, as a result of a succession of postulates and assumptions, arrived at Mrs. Robinson's Golden Age[1] of equilibrium growth with full employment. Her picturesque phrase provides, I think, a convenient method of identification, provided that the emotive undertones remain subdued. We must guard against any suggestion that the Golden Age is an ideal. Mrs. Robinson herself points out that a higher rate of accumulation than seems to be called for to secure a Golden Age with given technical conditions is likely itself to alter the conditions, and in particular the rate of technical progress: 'the pressure of scarcity of labour, driving up wage-rates, would induce more inventions to be made, and hasten the diffusion of improvements already known'. In other words, Mrs. Robinson is pointing out the unreality of the heroic assumptions, as I have described them, about technical progress. Moreover, we must be careful not to exclude, as a possibly more desirable alternative, a higher rate of growth of consumption, obtained at the expense of a temporarily lower current level of consumption, as a result of a higher rate of growth of capital and consequent progression to higher degrees of mechanization. In other words, we have to consider Mr. Little's *platinum age*[2] as a possibly more desirable alternative to Mrs. Robinson's Golden Age.

A further reason for guarding against the implication that a Golden Age represents some kind of ideal is that any particular Golden Age is based on given thriftiness of capitalists and of wage-earners. A higher proportion of incomes saved, on the part of either or both, would mean that, given the state and growth of technical knowledge and given the growth of population, the Golden Age would have built into it a lower rate of profit, so as to secure the correct relationship with an unchanged rate of growth of capital (equal to the rate of technical progress *plus* the rate of growth of population).[3] This lower rate of profit would, at each moment of time, go with a higher degree of mechanization than in the Golden Age adjusted to the lower level of thriftiness, and it would go with a larger total output, with a larger output of consumption goods, and with a higher wage-rate.

There is a practical reason why it is important to consider the implications of the degree of thriftiness. In the usual models of economic growth,

[1] Joan Robinson, op. cit., p. 99.

[2] See I. M. D. Little, loc. cit., p. 172.

[3] A cursory inspection of the relationship, as set out in my first footnote, might suggest that the capitalists' and wage-earners' savings coefficients, α and β, pull in opposite directions on the rate of profit called for by a given rate of growth. But this is illusory. The expression can be redeployed so that the factor $(\alpha - \beta)$ no longer occurs, and it should be borne in mind that the reciprocal of the capital-output ratio must exceed the rate of profit if wages are not to be negative.

such as Mrs. Robinson's Golden Age, the State is left out of the picture and in particular there is no room for saving by the State. Now, an economy might be developing as a Golden Age, but, thriftiness being low, the methods of production are often so primitive, as a result of scarcity of capital, that the word 'golden' is a mockery. The practical question which then arises is whether the economy would not be in a happier condition if the State were contributing to saving out of the proceeds of higher taxes. For the purpose of analysis one can regard such State saving as assimilated into the simpler model which disregards it. For in so far as it is financed by taxation of profits its effects are the same as those of a higher capitalists' savings coefficient; in so far as it is financed by indirect taxation, it is equivalent in its effects to those of higher savings coefficients for both capitalists and wage-earners, to the extent of their consumption of the taxed commodities.[1]

I must now emphasize that what is involved in this line of exercise is a comparison of the Golden Ages between which there exists a stated difference but which in other respects are subject to the same conditions. It is one thing to *correlate* two characteristics involved in such a comparison, such as the savings coefficients on the one hand and on the other hand the rate of profit and the degree of mechanization—but it would be quite another thing, for which justification would have to be produced, to regard the one as causatively determining the other.

This brings me to the more fundamental question what process of causation might be held conceptually responsible for the establishment and persistence of any particular Golden Age. The simplest case to conceive is that in which for a long time in the past the underlying conditions have operated in a constant and uniform manner and the Golden Age appropriate to them has in fact existed. A tranquil past breeds expectations based on past experience. The constant rate of profit is, as a matter of expectation, firmly based on experience. The structure of capital—and in particular the proportions in which specialized equipment is divided between what is

[1] The beneficial influence on the wage-rate associated with a higher degree of thrift is the larger, the smaller is the effect (expressed algebraically) in causing the capital-output ratio to be higher. This effect is smaller

(i) the smaller is the substitutibility of capital and labour;

(ii) the smaller is the effect of a higher wage-rate, and the larger is the effect in the opposite direction of a lower rate of profit, on the prices of particular kinds of capital-goods in terms of consumption-goods.

If these factors operate with sufficient strength, higher thrift will benefit wages to such a degree that even though practised entirely by wage-earners, their standard of living is on the average actually higher, in each state of technical knowledge, despite the higher thrift.

It then follows equally, under such conditions, that indirect taxes devoted to State saving, even if confined to commodities consumed by wage-earners, will actually entail *higher* real wage-rates (and that taxation of wages, devoted to State saving, will entail wages which are higher by more than the amount of the taxes paid out of them).

designed for making consumption-goods, for making capital-goods for making consumption-goods, and for making capital-goods for making capital-goods—is such as to result in a flow of capital-goods the value of which grows at the same rate as the value of the total stock of capital. As Mrs. Robinson puts it, entrepreneurs 'desire to accumulate at the same proportional rate as they have been doing over the past'.

This explanation is, however, too general. It justifies a state of equilibrium growth at *any* conceivable rate—what the rate happens to be being a matter of historical accident. It might be a rate less than the rate of technical progress, so as to result in steadily diminishing employment even though the population was constant or growing. And, as I have already indicated, the rate of growth may exceed the rate of technical progress, and employment may therefore be growing, but there may nevertheless be unemployment. It seems to me convenient to be able to describe such a state of equilibrium growth which has all the attributes of a Golden Age other than that of full employment. I suggest that it be called a Bastard Golden Age.

I now want to inquire whether there is any mechanism which can be said to determine the existence of a Golden Age proper, with a determined rate of growth, as opposed to a Bastard Golden Age with a rate of growth dependent on historical accident. What mechanism is there which is brought into operation at the point of full employment? Clearly we do not need to look beyond the familiar Keynesian rationalization of the classical processes of thought. The decision to invest depends not only on the prospective profit but on a comparison of that profit with the cost of financing the investment or, if the finance is available from internal sources, with the yield which could be secured by using it on the financial and capital markets. In simple terms any Golden Age, whether bastard or legitimate, must have had built into it a rate of interest which matches the rate of profit, and which discourages capitalists from embarking on projects likely to yield less than the Golden Age rate of profit. This rate of interest is not to be conceived in any simple sense. It is simply a phrase used for convenience to sum up the state of finance. The risks of enterprise must be allowed for. The fact that in a Golden Age capitalists' expectations are realized *in the broad* does not exclude the risks involved in the vagaries of technical processes and of consumers' behaviour. For these reasons the risk-free rate of interest would even in a Golden Age lie below the rate of profit, with which yields on ordinary shares are more comparable since they involve the same kind of risks as physical investment. Imperfections of the financial and capital markets are also likely to be important factors limiting investment. To meet the requirements of a Golden Age it is only necessary to assume either that the number of

capitalists grows at the Golden Age rate of growth or that the limits on the finance available to each expand on the average at the same rate of growth.

The possibility of a Bastard Golden Age turns on the absence of any progressive tendency towards the easing of the state of finance, and, more particularly, towards a lowering of rates of interest and of yields on ordinary shares. If, for example, money wage-rates tend to fall progressively under the pressure of unemployment or the quantity of money tends to rise faster than money wages or the monetary authority in the face of unemployment deliberately makes credit progressively cheaper, there will be such a progressive tendency and this will undermine the equilibrium of a Bastard Golden Age. In the absence of unemployment, on the other hand, there need be no such progressive easing of the state of finance. And with full employment any momentary tendency for investment to rise above the equilibrium rate will result in money wages being forced up under the pressure of unsatisfied demand for labour, until investment is pushed back to the Golden Age equilibrium rate. The rate of growth of a legitimate Golden Age, which grows in such a way as to maintain full employment, can thus be based on some idea of determinacy and not just historical accident.

Once the rate of growth is tethered in this way so that it can be inferred from the rate of technical progress and the rate of growth of population, it is possible to say that the rate of profit is *determined* by the rate of growth and by the savings coefficients.

Looked at in this way a statement that thrift has no influence on the rate of growth of capital is devoid of significance. If the rate of growth is determined in such a way as to secure full employment, it must match the growth of technical knowledge and population, and that is what it has to be equal to.

Thrift is important, however, because it determines the real wage-rate in a Golden Age, with given technical conditions at each stage and given rates of neutral technical progress and growth of population. In a certain sense growth is easier if at each stage the real wage-rate is higher—in the sense that a smaller sacrifice is called for from wage-earners. In this sense thrift is helpful to the process of growth.

This brings me to the 'inflation barrier'.[1] So far I have assumed that any real wage will be tolerated, no matter how low, and that only the approach to full employment will bring into operation a financial check resulting from the inflationary pressure on money wages of an unsatisfied demand for labour. It may be, however, that real wages which fail to reach a certain limit are unacceptable, in the sense that any attempt to enforce such real wages, even with the existence of unemployment, will

[1] Joan Robinson, op. cit., p. 48.

bring into operation an inflationary movement of money wages such as will result in a check on investment through its effect on the state of finance. Or the real wage may lie below the subsistence level. The inflation barrier is the minimum real wage-rate which will be tolerated without provoking reactions inconsistent with a state of equilibrium growth. To that minimum real wage-rate there corresponds, given the technical and thriftiness conditions, a particular Bastard Golden Age, with a rate of growth just sufficiently low to secure this minimum real wage-rate for those employed.[1] In such a Bastard Golden Age, the rate of growth is limited by the operation of the inflation barrier. Thrift can now be regarded as an influence on the rate of growth. It is the real wage-rate which is independently determined and greater thriftiness means a higher rate of growth and a less rapid increase of unemployment.

The inflation barrier may be in operation for a time even though the Golden Age real wage would be perfectly acceptable to the wage-earners. It may be that on account of the character of the development of the system back in history, unemployment still prevails and that the maximum possible rate of equilibrium growth is such as to bring the real wage-rate to the minimum and the inflation barrier into operation. Any higher rate of growth would bring inflationary forces into operation against itself; while any lower rate would be inconsistent with equilibrium because the state of finance would progressively ease, as a result of the existence of unemployment for which the inflation barrier was not responsible. Full equilibrium will therefore demand a Bastard Golden Age with a rate of growth greater than the legitimate Golden Age rate. Unemployment will progressively diminish until, with full employment in sight, there is no longer a valid basis for this Bastard Golden Age. The speed with which the position of full employment is attained will depend on the operation of the inflation barrier—the higher the minimum real wage-rate the lower the speed will be. It is shortage of capital which is the cause of such unemployment and the remedying of the shortage depends on the readiness of those who are in employment to make a temporary sacrifice on their real wage-rate.[2] And of course thrift here again operates as an influence

[1] To make equilibrium growth possible, it must be assumed either that there is no technical progress, so that the real wage-rate is constant, or that the minimum real wage-rate which constitutes the inflation barrier rises, as a matter of human progress and the development of ideas about minimum standards, at the same rate, purely by way of coincidence, as the rate of technical progress.

Professor Champernowne introduces the inflation barrier in terms purely of a minimum rate of growth of the minimum real wage-rate, the absolute level at any stage of development being apparently immaterial (loc. cit., p. 224).

[2] It is realistic to conceive of the inflation barrier to operate, as I do here, in terms of a minimum real wage-rate. It would be more logical but less realistic, to conceive it to operate in terms of the standard of living of those employed, after allowance for the support of the unemployed, or, better still, of the average standard of living of all the potential wage-earners, including the unemployed.

on the rate of growth—the greater the savings propensities, the more rapidly will the shortage of capital be overcome and unemployment be eliminated.

I now want to say something about the relation between profits and investment. In ordinary short-period economics, we are in the habit of associating higher profits with greater investment. This association involves two entirely different meanings of the word 'profit' and two different processes of cause and effect. The word 'profit' is often loosely used to signify what I have called capitalists' current incomes. In that sense high profits are caused by high investment—purely as a current phenomenon. But if the emphasis is on 'rate of profit', then it is the expectation of capitalists' incomes which is the subject of the association with the rate of investment, and the causation is the other way round: high investment is caused by high profits. In dealing with problems of non-equilibrium growth, such as I am not attempting, the difference between the two concepts of profit, and between the two types of causation, should be kept firmly in mind. With equilibrium growth the future is like the present. But although the rate of profit is the same viewed in current terms as in terms of expectations, the nature of the causation is still important.

If two different Golden Ages are compared, with the same savings coefficients but different rates of growth, the higher rate of growth is associated with the higher rate of profit.[1] This higher rate of profit is to be attributed to the higher rate of growth of capital rather than the other way round.

Indeed, in all these cases of equilibrium growth—Bastard as well as legitimate Golden Ages—the rate of growth of capital is inferred from factors other than profits: from rates of technical progress and population growth, from the minimum real wage-rate which constitutes the inflation barrier, and from pure historical accident. The reason why the causation does not operate the other way round as well is that a state of equilibrium growth requires a state of finance which has been built into the equilibrium system, in such a way that the deterrent influence on investment of the difficulty and cost of financing investment, and of the attraction of alternative methods of laying out financial resources, just matches the stimulating influence of profit expectations. The rate of interest, and all that goes with it in the financial sphere, has accommodated itself to the rate of profit and neither the rate of profit nor the rate of interest can be regarded as independent influences on investment.

This leads to the question what happens if the appropriate rate of

[1] Once again wage-earners' thrift is taken to be small.

profit is too low to be matched by the terms on which finance can be made available. There is in practice a minimum—a bottom-stop—below which it is difficult, or impossible, for the rate of interest to be forced down by monetary means.[1] Even if any particular minimum is likely to be broken down after long experience of consistently very low rates of interest, it is relevant that negative rates of interest are not conceivable and that the risk premium has to be added on to the rate of interest before the rate of profit is matched against it. If finance cannot become sufficiently easy to match the Golden Age rate of profit, and if other methods of stimulating investment are excluded, then the Golden Age is not possible.

Mr. Kaldor has pointed out that an expectation of rising prices can in such a situation provide a basis for a Golden Age and save the economy from the decay which is the alternative. If we continue to calculate our values in terms of consumption-goods rather than money, we must represent such an expectation as a lowering of the 'real' rate of interest corresponding to any particular money rate of interest bottom-stop, leaving the Golden Age rate of profit and rate of growth unaffected. If, on the other hand, we prefer to think in terms of the money rate of interest, then the rate of profit and rate of growth must be evaluated in money rather than in real terms and they will both be greater by reason of the rising prices.

Or rather this will be so if income is defined so as to include the increase in the value of capital equipment resulting from the rise in prices. If, on the other hand, the normal social accounting definition of income is employed, it makes no difference to the evaluation of the rate of growth whether prices are rising or not. And it makes no difference to the ratio of capitalists' current incomes to the value of the stock of capital. But this ratio is not a rate of profit which can be set against the rate of interest. As the prospective change in the value of capital equipment is left out of the account, the return from a given amount of current investment measured in money of current purchasing power is an annuity, the elements of which are progressively greater, on account of the expected rise in prices, as they attach to more distant points of time in the future. By reason of the expectation of rising prices, the rate of profit in the relevant sense exceeds the ratio of capitalists' current incomes to the value of the stock of capital.

Profit expectations and the rate of interest are not, in ordinary short-period economics, the only influences on investment. Having decided that neither of them has any influence on the rate of long-period equilibrium growth, I go on to ask myself about the part played in a Golden Age by

[1] See Keynes, *General Theory*, p. 309.

Keynes' 'animal spirits'—'a spontaneous urge to action rather than inaction. . . . If the animal spirits are dimmed . . . enterprise will fade and die.'[1]

High animal spirits can usefully be considered in four different aspects:

(i) They promote the growth of scientific knowledge. In this aspect they take a part in contributing to the rate of growth of the Golden Age.

(ii) They promote the exploitation of scientific knowledge, i.e. its conversion into technical knowledge. This is a more important way in which again they promote technical progress, and the growth of the Golden Age.

(iii) They promote an optimistic view of the future. In this aspect high animal spirits are incompatible with the conditions of a Golden Age, in which the prospect of the future is strictly determined by knowledge of the present and the past.

(iv) On the basis of given expectations, high animal spirits strengthen the urge to invest. In this aspect high animal spirits are in no sense incompatible with the conditions of a Golden Age. But they exert no influence on the rate of growth, their effect being rendered nugatory by reason of the terms on which finance is available. The stronger the animal spirits the higher has to be the rate of interest, and the tighter generally have to be financial conditions, while the rate of profit is unaffected.

In conclusion, I want to emphasize what I have *not* been doing in this lecture. I have talked about Golden Ages. But I have only touched on the question whether a system which is in Golden Age equilibrium is likely to stay there. And I have not discussed at all the really important question whether a system which is not in Golden Age equilibrium will tend to move towards the Golden Age.

Equally, I have not discussed what would be entailed in a movement, if it could be contrived, out of one Golden Age into another, within some definite limited period of time—or out of a Bastard Golden Age into a legitimate Golden Age. For example, I indicated that, other things being the same, if two Golden Ages differed only in respect of thrift, the one with the higher thrift was the preferable one, and that it was possible that even though the extra thrift was entirely at the expense of the wage-earners, the actual standard of wage-earners' consumption might be higher as a result of it. But when one speaks of a Golden Age being preferable in that sort of sense, it means that it would be preferable to be in it. But to be in it involves *having* been in it for a long time past, and

[1] Keynes, *General Theory*, pp. 161–2.

enjoying the legacy of the past in terms of the accumulated stock of capital and the degree of mechanization. The desirability of a movement from the one Golden Age to the other, and the manner in which it might be smoothly negotiated, is one of the important and difficult problems of economic growth. What I have said in this lecture is intended as no more than prolegomena to the solution of the real problems.

SOME PROBLEMS OF DEFINITION AND MEASUREMENT OF CAPITAL

By JOAN ROBINSON

We are concerned, in this paper, with capital as a factor of production, that is capital in the sense in which it consists of a mass of buildings, machinery, roads, ditches, stocks of goods, &c. We are not at the moment interested in drawing the line between capital goods and land, or between producer's and consumer's capital. We are concerned rather with the problems of measurement which arise after the decision has been made as to what concrete items are to be included in the enumeration.

In particular, we are concerned with the difficulty that arises out of the fact that the use of capital goods is spread out through time while the measure that we are looking for is a value at a moment of time.

I

Why do we want to be able to measure a collection of capital goods? They are what they are and they will be what they will be. Adding numerical labels to them will not affect their performance. All the same it is convenient to be able to talk about them in quantitative terms.

The questions into which quantities of capital goods enter may be divided into descriptive and operational. The questions which I call descriptive involve the valuation of stocks of capital goods in existence. We may be interested in comparing stocks at one date and another in a particular country, in order to see how it is doing. How far has recent investment exceeded the wear and tear of old equipment? Have the ravages of war been made good? Has productive capital been increasing as fast or faster than the potential labour force? Or again, we may be interested in comparing stocks of capital in different countries at the same date. How far is the superior productivity of American industry due to having more capital and how far to superior organization and technique? Or combining the two, we may be interested in comparing rates of growth of the stock of capital in two economies. Similarly we may be interested in questions concerning particular industries. All this has implications for policy, but the questions in themselves are concerned only with description.

The operational questions are directly concerned with what is to be done —how can given investible resources best be used? Here is a fund not yet embodied in concrete form—how should the choice be made of the form

it is to take? This involves comparing potential stocks of capital goods in terms of their potential performance in order to choose which of the possible alternatives is to be made actual in a scheme of investment.

II

In both sets of questions the value of capital is, so to say, a forward-looking concept. The significance of a stock of capital goods lies in its earning power to a business or its productivity to society, and the historic cost of the stock is of importance only as a clue to its value.

Today is a break in time dividing an irrevocable past from an uncertain future. In general, the stock of capital in existence today has been influenced by expectations held in the past which have turned out to have been at least partly mistaken. The stock today is not just what it would have been if all those concerned in the past had known what expectations about the future would be held today. Its value today is to some extent out of line with its costs (how much out of line depending upon the extent to which events have been upsetting expectations over the relevant past). Moreover, its value today depends upon estimates of the future which vary from one man to another and are in any case known to be liable to error.

Here lie the most formidable difficulties surrounding the concept of capital, which in fact make it impossible to give an unambiguous simple meaning to the phrase 'the value of a stock of capital goods'. But it is all a matter of degree. Some periods falsify expectations less than others. Let us, for the sake of argument, reduce the degree of ambiguity to vanishing point by postulating an economy which has long been evolving in conditions of perfect tranquillity with expectations, confidently held, which in fact have never been falsified as time rolls on in an eventless history. If we further postulate that these expectations, ever justified and therefore renewed, are that the rate of return realized on investment will always be constant, then there is no inherent difficulty in valuing capital, though there are a number of puzzles to be cleared up.

III

First we must clear out of the way a point that has often caused misunderstandings. Capitalist firms are extremely various and extremely complicated in nature. To conduct a simple analysis it is necessary to take a highly stylized 'firm' as the subject of the argument. One way is to endow the firm with an existence of its own as a 'unit of entrepreneurship' which enjoys diminishing returns from the application of factors of production to itself. Its objective, in the various decisions it has to take, is to maximize *net profit per annum to the firm*, and it can borrow finance, just as it hires labour, in an open factor market.

In the other stylized picture, the firm is simply the capital invested in it, managed by a disembodied entrepreneur, and its object is to secure the highest *rate of profit on capital*. In this picture the size of the firm need not be limited by any technical or managerial considerations, yielding diminishing returns to size, but at any moment it has limited resources already embodied in it and a limited amount of new finance that it can invest in the immediate future, though there need be no limit to the size that it can reach, given endless time.

In my first book I used the former picture, but it now seems to me both more complicated and less life-like than the latter. In any case, for the purpose of the present discussion, I shall postulate that firms carry out their investment plans with a view to obtaining the best possible rate of profit on the finance that is available to them. If so, the supply price of finance for a particular scheme of investment is an opportunity cost—the profit that could have been expected from the best alternative scheme. In our ideal tranquil world, assuming mobility of investment between markets, the cost of finance to any one line is simply the general rate of profit, and the rate of interest paid for loans is assimilated to it.

IV

Now, in our tranquil world where steady and confident expectations have long prevailed there is a definite rate of profit which is entailed by the past and expected future prices, wage rates, technical conditions, &c. Since tomorrow is always in course of becoming yesterday without any perceptible break at today, the value of a stock of capital goods regarded as discounted future earnings must be equal to its cost, including in cost interest on outlays made in the past compounded up today, and deducting from cost earnings, similarly compounded, that have already accrued. The value and the cost must be equal simply because we assume that no mistakes have been made. The costs would not have been incurred if they were not going to produce the value.

We can imagine that an all-seeing observer finds out the rate of profit entailed in a given pattern of past and future prices, wages, &c., by the following procedure. Begin by guessing a rate of interest and reckon the value and the cost of capital goods on that basis. If, say, the cost appears to exceed the value, the rate of interest chosen was too high. At a lower rate of discount the present value of the same future earnings is higher and at a lower rate of interest the cost is lower. The rate of interest which equalizes value and cost is the rate of profit inherent in the given present and future prices, wage rates, &c.

Once we have discovered the rate of profit ruling in our tranquil world we can use it as a rate of interest entering into the cost and the valuation

of particular capital goods, and so reduce them all to a common unit of measurement.

But what do we mean, exactly, by a unit of measurement to be applied to capital goods which offer a variety of time patterns of future yields? It seems to me that the natural approach is to reduce each to terms of an equivalent balanced stock of capital goods—that is a stock whose age composition is such that a given rate of growth (which may be zero) in annual gross investment produces the same rate of growth in the stock.

There is entailed in the stock today a particular past history, and if the stock is balanced there must have been a particular historical pattern in the gross investment which has brought it into being. To take the simple static case, suppose that the stock is being just maintained, without growth. Then if the investment which brought it into being began at a particular date in the past, a rate of gross investment equal to its present wear and tear must have been carried out from the beginning. Say it is made up of separate sets of items of equipment, each costing K when new, having a useful life of T years. Then if there is in existence today a static stock of this equipment, there must have been an investment of K every year for the last T years.

There is no reason why any particular capitalist or any whole economy should get into balance in this way, but the balanced stock provides a standard of comparison, and a formula which permits us to reduce all stocks, whatever their time pattern, to terms of an equivalent balanced stock, provides the unit of measurement that we are looking for.

A formula has been provided by Professors Kahn and Champerowne[1] which operates on certain simplifying assumptions.

First, the gestation period during which outlay is incurred to build up the stock of capital goods is taken to be sharply distinct from the period when earning begins. This means that we can take a definite sum, K, as the cost of a particular item of equipment brand new and just ready to begin production. Second, it is assumed that quasi-rent (that is, total receipts *minus* wages and other running costs) accrues continuously at an even rate over the life-time of the equipment and that its life comes to a sudden end, leaving no scrap value, at a particular age (this is known as the one-hoss-shay assumption, in allusion to the famous poem.[2])

The third assumption which the formula requires is static conditions, in the sense that the value of the stock of capital to which it applies is constant through time.

[1] See the Appendix to my *Accumulation of Capital*.

[2] Have you heard of the wonderful one-hoss shay
That was built in such a logical way
It ran a hundred years to a day?

The Deacon's Masterpiece by Oliver Wendell Holmes.

The formula is $$C/K = \frac{1}{1-e^{-rT}} - \frac{1}{rT}$$

where C is the value of the investment represented by the equipment whose cost is K, r the instantaneous rate of profit and T the length of life of the equipment.

This yields useful simple approximations for two ranges of values of rT. For values of rT above 4 the approximation is: $C/K = 1-1/rT$ and for values below 2, $C/K = \frac{1}{2}+\frac{1}{12}rT$. Thus if T is, say, 50 years and r something more than 8 per cent. per annum, the value of the investment is more than three-quarters of the initial cost. If T is, say, 10 years and r something less than 20 per cent., the value exceeds half the initial cost by less than one-sixth.

What is the significance of the assumptions that lead to these simple results?

The first simplification (treating the gestation period and earning period separately) is merely an expository device and involves no point of principle.

The second (the one-hoss-shay assumption) merely means that a particular pattern of earnings (the simplest) has been picked out to illustrate the general case.

The third assumption, static conditions, involves a matter of principle. The conception of a balanced stock of plant, continually maintained in being by a constant rate of gross investment, and yielding a constant flow of output, would be inappropriate in a growing economy.

This limitation upon the formula can be removed provided that growth is conceived to take place at a steady rate.[1]

When α is the steady rate of growth

$$C/K = \frac{1}{1-e^{-rT}} - \frac{1}{(r-\alpha)T} \cdot \frac{\alpha T}{e^{\alpha T}-1} \cdot \frac{1-e^{-(r-\alpha)T}}{1-e^{-rT}}.$$

When $\alpha = 0$, this reduces to the original formula given above. When rT and αT are small, the following approximation is useful:

$$C/K = \tfrac{1}{2}+\tfrac{1}{12}(r+\alpha)T.$$

Taking the second example above, with $T = 10$ years and $r = 20$ per cent., so that in the static case $C = (\frac{1}{2}+\frac{1}{6})K$, then if α is say 4 per cent. $C = (\frac{1}{2}+\frac{1}{3})K$.

On this basis, provided that perfect tranquillity prevails and the rate of profit is constant, we can value a stock of capital goods just as before. The only difference is that we take into account the fact that the more rapid the steady rate of growth that is taking place (other things equal) the

[1] The amended formula has been supplied by Professor Champerowne who assures me that the proof is elementary.

lower is the average age of individual items of equipment and so the higher is the ratio of C to K. With very rapid rates of growth, C approximates to K.

V

So far we have relied upon a constant, uniform, and unambiguous rate of profit. It is possible to compare situations technically alike with different rates of profit, the given rate of profit having been constant for some time in each, and being expected to remain so.[1] This is at best a classroom exercise, for in reality it is very improbable that the same technical conditions would be found with different interest rates. It is useful, however, to draw attention to certain conceptual notions. When we are comparing two situations with different rates of profit there is no unit of value which is in common between them, for the pattern of purchasing power is different. If near-enough the same commodities are consumed in each economy, in near-enough the same proportions, we can use a basket of consumer goods as a unit of measurement, but the real wage rate must be different when technical conditions are alike and the rate of profit different. The purchasing power of commodities over labour is therefore different in the two cases. Thus our two situations have no measuring rod in common. To evaluate our two stocks of capital (granted all the data and all the tranquillity and all the confidence in expectations that we can ask for) we have to use a multiple measure—say one is so much greater than the other when valued in terms of labour time but so much smaller when valued in terms of commodities. All this is very much 'economics for economists' and most even of economists seem to find it rather funny.

VI

When it comes to comparing actual stocks of capital goods at actual moments of time in actual economies, generally both rates of profit and technical conditions are different and we have to admit frankly that we cannot even say with any exactitude what it is we are trying to measure. On top of that the data that we have to deal with are imperfect and ambiguous to an exasperating extent.

This is not a reason to fall into a state of intellectual nihilism and refuse to say anything.

In commonsense terms the stock of capital *is* larger in some economies than in others, and in most it is changing through time. The crudest measures, say, cost written down at the rate permitted by the tax authorities, the business man's own valuation as shown by the books of firms, or

[1] Cf. *Accumulation of Capital*, chapters 11 and 12.

estimated replacement cost with a rough allowance for age, are better than none.

The important thing is to keep a firm grip on the distinction between value of capital per unit of output and value of capital per man employed. In technically progressive economies we expect to find capital per unit of output more or less constant over the long run while capital per man employed is steadily rising. Where capital per man and capital per unit of output are both constant there is no technical progress, but accumulation is adjusted to the growth of the labour force. Where capital per head and capital per unit of output are both rising we have a case that can be interpreted in terms of a neo-classical production function.

Questions of this kind are of the greatest interest, and it is worthwhile to try to answer them, no matter that the measurements involved are crude, imprecise or even ambiguous when it comes to fine details.

VII

So much for the descriptive questions. Now consider operational questions, connected with investment decisions, returning once more to the tranquil world of confident expectations and a single ruling rate of profit. The operational questions are set out in a manner quite different from the descriptive questions. We stand, so to say, at the elbow of a would-be investor, today, looking into the future. The investor has to dispose of uncommitted funds of the value K, and he is considering how to use them. The concept of a balanced stock of capital is now of no relevance. To build up and maintain a static balanced stock he would have to continue into the future investing K per unit of time. This indeed is how working capital operates, but for long-lived equipment there is no sense in asking our investor to commit himself to such a programme. (It is true that an individual investor can acquire a balanced stock of plant by buying in the second-hand market, but this is only shifting the problem from his shoulders to others.) We must consider the present act of investment of K on its own merits.

Let us suppose that the investor is contemplating the purchase of a one-hoss-shay type of equipment, ready to start production, which promises to yield an excess of receipts over running cost (quasi-rent) of Q per annum for T years.

To see whether this investment will yield the going rate of profit he must discount the dated future Qs at the ruling rate back to today; if the sum so arrived at is not less than K, the investment passes the test of eligibility.

Another way of looking at the calculation is to consider what income could permanently be drawn from the investment. This means that each

incarnation of the finance in concrete capital goods is amortized over the life-time of the equipment, so that every T years the finance, K, appears again in a liquid form ready to be invested, while all the time a constant income per annum is being netted off. If Y is the permanent disposable income, then when Y/K is not less than the ruling rate of profit, the investment is eligible. The proof that these two ways of looking at the question are equivalent is set out in the appendix below.

On this basis the investor can be conceived to choose between possible schemes of investment, rejecting any that do not promise to yield at least the going rate of profit on the sum K.

The basis of the calculation is an implied understanding that any investment of finance, once made, is to be a permanent addition to the stock of capital. It is true that an individual capitalist may contemplate consuming his gross profits, so that at the end of T years he is left with nothing, but an economist would account for his behaviour by saying that he discounts the future at more than the ruling rate of profit. The investment which is intended to be permanent is the normal one that provides the basis for the calculation. If it were normal to allow an investment of finance to evaporate with the physical life of the plant in which it is embodied (as is, indeed, normal in the case of consumer's capital) our whole approach would be different. For the descriptive question we took as normal a stock of capital kept in being by replacements. In this case we take it as normal that an investment of finance, once made, will not be disinvested, though the capital goods in which it is first embodied disintegrate in time. Thus in both cases we are basing our arithmetic upon the moral principle of 'keeping capital intact'.

At first sight there seems to be an inconsistency between the two formulations. How can the very same act of investment produce a capital of K and a capital of only C? The answer is that it depends upon the point of view—the point of view of the individual investor or of the economy as a whole—the points of view of finance capital and of physical capital. Our investor who owns funds of K looks for a return at the ruling rate on K, and this he can get by purchasing a piece of equipment, whose earnings will enable him to amortize the investment over its life. He is in possession of physical equipment which will have an average value over its life equal to C. But from his own point of view he is confidently looking forward to a perpetual yield equal to the ruling rate of profit on K. For him, the difference between K and C is made up by lending his amortization quotas to finance other physical investments. When the economy of which he forms part is stationary, these other physical investments are replacements of pre-existing equipment. When the economy is growing, what from his point of view is only amortization helps to finance new investment. This

is shown in the formula by the fact that C/K is greater the more rapid the rate of accumulation that is going on.

VIII

In our operational, as in our descriptive problems, we are relying heavily on the postulate of a single, constant, confidently expected rate of profit in the economy as a whole.

When there is an expectation that the rate of profit is going to change in the future the analysis becomes extremely complicated. There is then a different rate of interest appropriate to every length of time—for instance if the complex of profit rates is expected to fall, each shorter rate is higher than the next longer (as with the bill and bond rate in the money market). To choose an investment, different possible schemes must be compared with the appropriate discount rate applied to each piece of equipment according to its length of life.

This, once more, is economics for economists. Or rather it is not even that, for so far as I know, it has never been systematically worked out, and it is certainly beyond my powers to offer a formula to deal with it.

IX

When we descend further towards reality, and admit that future quasi-rents are uncertain and rates of profit ambiguous we are in as thick a fog as that surrounding descriptive questions about the value of actual stocks of capital goods.

But there is one big difference. If no one is brave enough to tackle the descriptive questions they go unanswered. *Tant pis.* But the operational questions have to be answered. Somehow or other investment decisions have to be taken. Even if they are taken on instinct or common sense, they conform more or less to our calculations, for the essence of the argument shown in our formulae is that the higher the rate of interest the greater the relative importance of yields in the near future compared to yields in a further future. Whether the rate of interest is taken to represent the scarcity of capital in a developing society, or the prospects of potential profits surrounding an individual firm, clearly the higher it is taken to be the greater the preference for quick-yielding investments. But to compare various alternatives with different time patterns, so to speak, with the naked eye, is possible only in very simple cases. Generally some calculation is necessary to reinforce common sense. For making the operational calculations no rate of interest is ever just the right one, but any rate of interest is better than none.

APPENDIX

An equipment, costing K when new, will yield a gross profit (quasi-rent) Q per annum for T years. At the rate of interest r, the present value of the investment is V.

$$V = Q\int_0^T e^{-rT}\,dt$$

$$\therefore V = \frac{Q}{r}(1-e^{-rT}). \tag{1}$$

Y = annual disposable income $= Q-x$.
A sinking fund is set up to provide a replacement costing K in T years.
Value of sinking fund (from x) after T years is

$$x\int_0^T e^{r(T-t)}\,dt = \frac{x}{r}(e^{rT}-1).$$

$$\therefore x = \frac{Kr}{e^{rT}-1}.$$

$$\therefore Y = Q-\frac{Kr}{e^{rT}-1}.$$

It is required to prove that, when $K = V$, $Y/K = r$.

If $$K = V, \frac{Y}{K} = \frac{Q}{K}-\frac{r}{(1+r)^T-1} = \frac{Q}{V}-\frac{r}{(1+r)^T-1}$$

by (1) $$\frac{Y}{K} = \frac{r}{1-(1+r)^{-T}}-\frac{r}{(1+r)^T-1}$$

$$= \frac{(1+r)^T r}{(1+r)^T-1}-\frac{r}{(1+r)^T-1}$$

$$= \frac{\{(1+r)^T-1\}r}{(1+r)^T-1} = r.$$

UNBALANCED GROWTH[1]

By PAUL STREETEN

Introduction

'EVERYTHING of importance has been said before, by someone who did not discover it.' Whitehead's dictum is probably also true of the doctrine of balanced growth. Friedrich List certainly formulated clearly the case for balanced national growth. In his *Nationale System der politischen Oekonomie*[2] he stressed the importance of development which is balanced between material and mental occupations,[3] between agriculture, manufacturing, and commerce,[4] and between different branches of manufacturing.[5] He saw clearly the connexion between development and complementarities both on the technical side[6] and on the side of demand.[7] He emphasized particularly the complementarity between transport and manufacturing[8] and the mutual stimulation of correctly composed production and consumption.[9] He warned, of course, above all against the dangers of lop-sided development that arise from specialization in primary production and reliance on imported manufactured goods.

Allyn Young, in his famous 1928 article, elaborated Adam Smith's proposition that the division of labour is limited by the extent of the market. He replaced 'division of labour' by 'inducement to invest', i.e. inducement to produce in a more capitalistic, 'roundabout' manner, and the geographical extent by the economic size of the market, i.e. the level of demand. And he made the two interdependent, subject to the qualification that supply must be balanced. The inducement to invest depends upon the size of the market, and the size of the market depends on productivity. But productivity in turn depends upon the use of capital whose application yields increasing returns. In Allyn Young's article, the doctrine of balanced growth appears as a qualification to Say's law. The size of the market, i.e. the level of demand, is determined by the volume of production, but 'the conception of a market in this inclusive sense—an aggregate of productive activities tied together by trade—carries with it the notion that there must be some sort of balance, that different productive activities must be proportioned to one another'.[10] 'The rate at which any one industry grows is conditioned by the rate at which other

[1] This article forms part of a wider study made possible by a Council of Europe Fellowship. I am indebted to the Council of Europe for the award and for allowing me to use the material here.

[2] 1841. The page references are to the edition by Heinrich Waentig.

[3] pp. 251, 328. [4] pp. 212, 251, 328, 332, 507. [5] p. 252.

[6] p. 252. [7] pp. 279–80. [8] p. 14 and other places. [9] p. 332.

[10] Allyn Young, 'Increasing Returns and Economic Progress', *Economic Journal*, Dec. 1928, p. 533.

industries grow, but since the elasticities of demand and of supply will differ for different products, some industries will grow faster than others. Even with a stationary population and in the absence of new discoveries in pure or applied science there are no limits to the process of expansion except the limits beyond which demand is not elastic and returns do not increase.'[1]

Mr. Rosenstein-Rodan developed the idea that the use of capital by any single entrepreneur is inhibited by the small size of the market for *his* product.[2] He modified Allyn Young's doctrine in two logically connected ways: first, investment of a largely widening type (as compared with Young's largely more 'roundabout' investment) is the generator of higher incomes; second, disguised unemployment provides the labour reserve for this increase. The market is enlarged not by improvements in productivity following investment, but by putting unemployed men to produce a balanced output. Increasing returns result not from technical economies but from external economies due to higher, mutually supporting, demand.

More recently the case for balanced growth has been restated and elaborated lucidly by Professor Ragnar Nurkse.[3] In his presentation balanced growth appears in the context of the size of the market and the inducement to invest. In his controversy with Mr. Fleming, it became clear that Nurkse assumes a given labour force and elastic capital supply.[4] On these assumptions the doctrine says that the inducement to invest will be stronger if any given amount of capital is applied to the production of a variety of products in accordance with income elasticities of demand,[5] than in any other way. It is fairly obvious that any *given* supply of capital is more profitably and more sensibly used in a balanced way. To say merely that the inducement to invest depends on the extent of the market in this sense is not very revealing, indeed is almost tautologous. Only by adding that the extent of the market also depends on the inducement to invest is the process of cumulative growth illuminated. The inducement to higher investment generates a larger market—either because of dis-

[1] Allyn Young, art. cit., p. 534. Young speaks here of an 'elastic demand' for a commodity 'in the special sense that a small increase in its supply will be attended by an increase in the amounts of other commodities which can be had in exchange for it'.

[2] Paul N. Rosenstein-Rodan, 'Problems of Industrialisation of Eastern and South-Eastern Europe', *Economic Journal*, June–Sept. 1943, pp. 205–7.

[3] Ragnar Nurkse, *Problems of Capital Formation in Under-developed Countries*, 1953, pp. 11–14. Ragnar Nurkse's tragic death occurred while this article was in the press. It will be obvious how much it owes to him. But beyond that, Nurkse was always patient, helpful and stimulating in his letters, allowing one to share his thoughts and opening new vistas. Both as a teacher and as a friend he will be greatly missed.

[4] R. Nurkse, 'Balanced Growth on Static Assumptions', *Economic Journal*, June 1956, pp. 365–7.

[5] Price elasticities would, of course, also have to be taken into account.

guised unemployment or because investment raises productivity—and this reinforces the inducement to invest. Either some reserve of unemployed or productivity-raising investment or both must be assumed in order to assert more than that any given supply of labour is used more efficiently if applied to the production of what is wanted than of what is unwanted.

To say that a small unbalanced investment project is worse than a large project of balanced investment is illuminating only if we add that several small and unprofitable projects would become profitable if undertaken together, lending each other support, either through cost reductions or through demand creation.

The doctrine of balanced growth is now widely accepted,[1] and balanced growth is almost axiomatic as a desirable objective, for both developed and under-developed countries, on both sides of the iron curtain. Such diverse sources as the numerous reports of missions of the International Bank for Reconstruction and Development, the *Monthly Letters* of the First National City Bank of New York, and the discussions on the *Economic Report of the President* bear witness to this.[2] In the Soviet Union, the doctrine appears as the 'Law of Planned, Proportionate Development', according to which the planning commission must insure that the rates of growth of the various sectors of the economy are consistent with one another and with the rate of final output implied by the policy directives of the government.[3]

Yet, occasional rumblings of dissent can be heard. Professor Kindleberger expressed an instinctive distrust of the doctrine of balanced growth:

> The choice between attacking on a wide front and storming key positions is a perennial one. . . . Without knowing which or how many priority targets must be attacked to get the dynamic process of economic development under way on a cumulative basis, instinct suggests that this may be a more fruitful method than balance. The Nurkse argument has a logical ring. But economic development in the past did not spring full blown from the brow of an economist. Nor is there any reason to think that it will be impossible to duplicate historical development which has been piecemeal in its strategic aspects, if one can duplicate the critical conditions or contrive a comparable set of interacting phenomena.[4]

[1] e.g. W. A. Lewis, *Theory of Economic Growth*, pp. 275–83; W. W. Lockwood, *The Economic Development of Japan*, p. 227; G. M. Meier and R. E. Baldwin, *Economic Development*, pp. 347–8, 361–2, 376, 400.

[2] *Report of the Joint Committee on the January 1956 Economic Report of the President*, Mar. 1956, p. 2. Similarly, the *Monthly Letter* of the First National City Bank of New York, e.g. Nov. 1957, p. 122. See also the American Federation of Labor-Congress of Industrial Organizations: *The National Economy in Review, Balanced Economic Growth Needed* (1957). It must be admitted that the expression often serves merely as a fashionable empty catch-phrase.

[3] See *Economic Survey of Europe in 1955*, p. 202.

[4] *Review of Economics and Statistics*, Nov. 1952, p. 392. More recently, however, the voices of opposition have been heard more loudly and more coherently. The most important plea for unbalance has been made by Albert O. Hirschman, whose book *The Strategy of Economic Development* reached me only after this essay had been written.

Now it is obvious that development *means* disturbing an equilibrium, upsetting a balance: the equilibrium of a stable society, the balance of forces that perpetuate the *status quo*. Is there more than instinct and platitude in the notion that unbalance and disturbance are of the very nature of growth?

The Meaning of Balanced Growth

Balanced growth has a variety of meanings, and different aspects have been stressed by different authors. I shall try to give a general definition that comprises the different meanings and emphases.

Whenever several non-infinitesimal investment decisions (or decisions generally) depend for their success upon each other, simultaneous investment (action) in a series of industries (or firms or plants) in conformity with the pattern of consumers' demand and of different industries' (firms', plants') demand for each other's products is required.

The investment decisions must be non-infinitesimal, for if investment could be carried out in infinitesimally small steps (and if entrepreneurial attention were perfectly divisible), successive investments in different lines would be possible and profitable.

To what extent actions must be strictly simultaneous will be discussed below (see p. 177). Balanced growth has a horizontal and a vertical aspect. It implies a balance between, say, shoes, food, and clothing, but also between agricultural raw materials and manufacturing production, between capital goods and consumers' goods, between public utilities and other investment, between exports and production for the home market, &c. The case for balanced growth rests upon the relation of complementarity between wants, between factors, and between factors and products at various stages of production.

The definition of balanced growth can be extended from investment decisions to economic activities generally, and even to any other events whose simultaneous presence is required in order to achieve a desired result (e.g. the decision to reduce the time for national service should be accompanied by a decision to enlarge the intake at universities).

The argument that balanced growth demands planning (public or private coordination of decisions) is based on the correct view that in a system where decisions on the production of complementary goods are taken separately, progress may be impaired if these decisions do not dovetail.[1] *Successive* adaptation, which is the chief virtue of the price

[1] In a lecture published in 1958, Nurkse says: 'According to some writers the balanced growth argument implies that the market mechanism is eliminated and that investments must be effected according to a coordinated plan. This opinion, which is widely held, seems to me dubious. . . . As a means of creating inducements to invest, balanced growth can be said to be relevant primarily to a private enterprise system. State investment can

mechanism (both as a system of signals and incentives), will not work, or will work only wastefully, for the complementarity demands that several things be done *simultaneously*, not successively. Nor is it, as one might think, a matter of promoting information and removing ignorance.[1] Since the success of *A*'s action depends upon *B*'s, and *vice versa*, full knowledge by each of the other's plans is no solution. The trouble arises not from an inconsistency of plans or from ignorance, but because, without a coordination of decisions (which may require central planning), no valid basis of correct anticipations of success exists.[2]

Thus the doctrine of balanced growth is right if it stresses that in certain conditions the obstacle created by one type of activity overshooting the mark *may* lead to losses and waste. There is no point in having a steel mill without fuel, electrical equipment without power; if essential imports are needed but there are no exports (or loans), production is brought to a stop; if savings are attempted but no investment occurs, they will be abortive; if capacity accumulates but there is no demand for its output, it will be wasted, &c. Unbalanced growth may not be growth at all. If a starving society raises its output of shirts by 10 per cent. but reduces its output of bread by 1 per cent., it cannot be said to have progressed. Unwanted production is not production.

But the doctrine is wrong if it maintains that unbalance *must* delay or halt progress. The tenor of the argument in this paper is that in certain conditions unbalance may stimulate rather than impair progress, that it may be a condition of, rather than an obstacle to, rapid growth, and that too great an emphasis on balance may cause, rather than prevent stagnation. Bottlenecks may not only, in some conditions, hold back production, but they may also, in other conditions, powerfully stimulate the growth of the complementary activity that has lagged behind.

and often does go ahead without any market incentives. Planning authorities can apply capital, if they have any, wherever they may choose. . . . It is private investment that is attracted by markets and that needs the inducement of growing markets. It is here that the element of mutual support is so useful and, for rapid growth, indispensable.' 'The Conflict between "Balanced Growth" and International Specialisation', *Lectures on Economic Development*, published by the Faculty of Economics, Istanbul University.

This argument is difficult to follow. Clearly both public and private investment can be and have been wasteful—where the dictates of balance are ignored (though we shall see that this need not be so). The point is that the price mechanism, by itself, does not produce that simultaneous, mutually supporting, advance that balanced growth requires. Only conscious coordination, which may be governmental or private, can do this.

[1] Messrs. Bauer and Yamey therefore appear to be mistaken when they argue that 'on the postulated asumptions that the combined group of activities would be economic and that the government is aware of this, there is a presumption that the industries would in fact be established if the information is made available and is encouraging'. *The Economics of Under-Developed Countries*, p. 249.

[2] On the other hand, pseudo-information may be as good as coordination. Thus the announcement by governments of development plans appears to have led in several countries to an increase in investment and output in the private sector, although the plans were not implemented.

Complementarity

Professor Nurkse writes:

> Most industries catering for mass consumption are *complementary* in the sense that they provide a market for, and thus support, each other. This basic *complementarity* stems, in the last analysis, from the diversity of human wants. The case for 'balanced growth' rests on the need for a 'balanced diet'.[1]

At first sight it looks as if the case for balanced growth rested on the complementarity of wants, or rather of consumption goods. Yet, complementarity can support the argument for unbalance.

A few words about complementarity should clarify the discussion. First, complementarity is a matter of degree. Where complementarity between two things is very strong we speak of one rather than two commodities or factors. A pair of shoes is *one* pair, not one left and one right shoe, except where one-legged markets are important. Complementarities in consumers' choice are likely to be weaker than complementarities dictated by technology,[2] although the latter can also be overcome through foreign trade.

Next, we may distinguish between complementarities according to the nature of the objects of the relationship. There are not only complementarities between human wants (bread and butter) or groups of wants[3] (bread and circuses, income and leisure), but also between factors of production,[4] (screws and nuts, locomotives and engine drivers), and between factors and products (usually called specificity of factors). There is also complementarity between decisions to save and to invest. If savings are attempted without investment income reduction will wipe them out; if attempted investment expands without savings, inflation will render some of it nugatory. Complementarity prevails between exports and imports, between exports and domestic production, between the present (consumption and production) and the future, between productive capacity and consumption.[5]

[1] Op. cit., p. 11. My italics.

[2] Some qualification is perhaps required. Although the plasticity of wants may be greater than that of technical requirements, postponement is much easier for the use of capital goods. Many capital goods are produced for use in the future and the supply of complementary goods can wait for a considerable time. In order to get efficient use of the investment sector in spite of an ill-balanced distribution of equipment or materials, price differentials need not be so great as they would have to be in the consumption sector. In both sectors increased availability of foreign exchange allows greater flexibility. On the relation of foreign trade to the doctrine of balanced growth, see below, pp. 184–6.

[3] Strictly speaking it is not the complementarity of wants that gives rise to the problem of balance, but the complementarity of consumption goods ministering to complementary or even the same wants. This type of complementarity has been stressed by Rosenstein-Rodan and Nurkse.

[4] e.g. in *Economic Survey of Europe in 1955*, Economic Commission for Europe, p. 76, W. Arthur Lewis, op. cit.

[5] This aspect is emphasized in the E.C.E. *Survey* quoted in the previous footnote. 'Balanced economic growth can be defined as a development in which the growth of consumption

Complementarities may also exist between what are usually taken to be the data and the variables of economic analysis. The existence of a market and of a legal system is a condition for the supply of factors. Similarly, technical education and entrepreneurial capacity are complementary; so are health and the supply of labour, &c.

Finally, we should distinguish between static and dynamic complementarities. Thus the complementarity of consumption goods may be due to either of two factors: the indivisibility of certain goods, or what might be called the anabolism[1] of wants. Only a static view of human nature takes the diversity of wants as given. The most important complementarities, however, arise in the process of rising consumption. Similarly, technical complementarities may arise or may become apparent only with the growth of knowledge and inventions. Investment (like consumption) may not only meet existing needs but generate new needs and new investment opportunities.

Progress consists in the discovery and generation of new wants clustering on each other, and of new technological gaps, as much as, or even more than, in meeting existing wants and filling existing technological gaps.

The following discussion will state the case for unbalance, first for consumption, then for production. Both will be subdivided into static arguments, concerned with indivisibilities in the face of given wants and technology, and dynamic arguments, dealing with the stimulus to new wants, new activities and technical innovations. Then the relationship between balanced or unbalanced growth and foreign transactions is examined. Finally, the argument is extended to apply to the relation between saving and investment.

Unbalance and Consumption

(*a*) *Indivisibility*

Common observation suggests and surveys confirm that most people think that, if their incomes were 20 per cent. higher, they would be comfortably off. This opinion does not appear to depend on how much income they actually get. It seems both to confirm (dynamically) and to contradict (statically) the doctrine of the insatiability of wants. One possible explanation of this puzzle lies in the fact that many commodities can be bought only in large and expensive units, so that either we overshoot the mark that would be dictated by equalising marginal utilities, and then

matches the growth of productive capacity in the consumer-goods sector.' P. 76. Similarly, the American Federation of Labour and Congress of Industrial Organisations emphasise in their pamphlet, sub-titled 'Balanced Economic Growth Needed', the relation between investment and consumption. *The National Economy in Review* (1957), p. 3.

[1] Anabolism (= constructive metabolism): 'The process in an organism or a single cell, by which nutritive material is built up into living matter.' *The Shorter Oxford English Dictionary.*

feel pinched in other directions, or we refrain from buying the commodity and then feel its absence acutely. The feeling of deprivation caused by our inability to equate marginal rates of substitution is as strong as the satisfaction from the additional consumption, and leaves us with the same feeling of discontent as before. Wicksteed expressed this point as follows:

> Thus, where large units come into competition with small ones and with each other, we are always vaguely conscious of either being in arrears or being in advance in our expenditure on the large units. If I have not a piano I am conscious of the pressure of an unsatisfied want which is slowly accumulating until it shall be of sufficient weight and volume to justify the whole expenditure. Meanwhile it is absolutely unsatisfied, whereas the wants to which smaller units minister are partially satisfied, though all the while I feel that they do not add as much to the value of life as an occasional hour of the piano would do if I could get it *pro rata parte* at a fraction of the price of complete command. And when I have got my piano I am conscious, from time to time, when my appetite for playing on an inferior instrument is temporarily sated, that I would very gladly curtail my opportunities of gratifying it, if I could thereby relieve the general pressure I feel at all the points at which small units might minister to unsated desires. Probably the impossibility of bringing these two classes of expenditure into perfect harmony goes a long way towards explaining that almost universal experience embodied in the aphorism, 'A competence is a little more than a man has.' Conscious of a ragged edge in our expenditure, and especially of some few things, purchasable in large units, of which we constantly feel the want, we imagine that if we had them we should be satisfied. As a matter of fact they have merely attracted to themselves our whole sense of dissatisfaction. If we got these particular articles, promontories would just at these points be substituted for bays, but the coast would be no more even than before. Certain other wants would now be realised and new voids would begin to ache. Perhaps we should be quite conscious that our general level of well-being and satisfaction was raised, but the vague uneasiness caused by the uneven edge would still be there.[1]

In fact, however, few services can be enjoyed only by purchasing indivisible commodities. Pianos and cars can be hired by the hour. The trouble is that consumption *pro rata*, though not impossible, is more expensive. An individual who equates marginal rates of substitution to price-ratios will be worse off than one who tolerates some imbalance. For the individual, just as for the nation (as we shall see later) there arises therefore a choice between higher real income (and therefore opportunity for faster growth) at the cost of imbalance and lower real income (and risk of slower growth) with the advantage of balance.[2]

(*b*) *Anabolism*

An observation of the growth of wants in a dynamic society shows that new wants are created in the process of satisfying existing ones, and that complex consumption patterns spring from simple innovations, 'as if increase of appetite had grown by what it fed on'. A swimming-pool in

[1] Wicksteed, *The Common Sense of Political Economy*, pp. 100–1.

[2] Hire-purchase would not meet the requirements, for the instalment payments are contractual commitments, and adjustments to changing requirements are impossible.

the garden requires of course all kinds of equipment to heat the water, disinfect it, drain it, remove algae, &c. But it also invites a flagstone terrace, the terrace demands deckchairs and tables and the tables insist on supporting martini glasses. And perhaps one wants to build a cabana and install underwater lights for night-swimming. Some people add an outdoor bar and a juke-box. High-fidelity enthusiasts are continually improving the weakest link in the chain of tuner, amplifier, player, speaker. But the elimination of the source of trouble always shows up the relative weakness of another link, on which all attention is then concentrated.

(c) *Complementarities and growth*

What are the relations between these complementarities and economic growth? First, imbalance may be a condition for attaining higher income than would otherwise be possible. But it provides also one of the answers to the question why consumption has risen with income to such a surprising extent, and why the fears of underconsumptionists have proved (relatively) unjustified. In a growing and enterprising society, these complementarities in consumption budgets provide a strong incentive for investment and further production, which would be absent had there been fully balanced growth, in conformity with the pattern of consumers' demand. If wants were satisfied by balanced growth, people would have to think up new ways of spending income. Inertia or lack of imagination may then prevent a further rise. But the complementarities, whether caused by indivisibility or anabolism, create pressures and a sense of deprivation, which stimulate and guide investment, and guarantee its profitability. Investment opportunities are created by new consumption opportunities which in turn result from unbalance.

It is true that some losses may (but need not) have to be set against these gains. The shift in demand towards the new items may be at the expense of industries from which the demand is diverted.[1] But since income grows, this need not be so, and even when there is an absolute decline in demand for a particular good or service there will be a net stimulus to investment, because disinvestment is limited to not replacing, whereas net investment can be larger.

A lack of balance might lead to a curtailment of the activity that has shot ahead, or it might stimulate the one that was left behind. A bottleneck can be eliminated by widening the bottleneck, or by reducing the flow through it. The rise in the use of cars has led to congestion on the roads. In America a $40 billion road-building programme is in progress,

[1] Perhaps 'metabolism', including the destructive process, (katabolism) is the better metaphor.

which will lead to the growth of motels and accessory services, and may even transform the face of the country. In Britain the instinctive reaction to traffic congestion has been to restrict motoring. In extreme cases of complementarity the investment without its complement is bound to be abortive. But when people respond to expansionist pressures, absence of balance is a powerful stimulus.

A high elasticity of supply will make it easier to accommodate unbalanced growth. But the process is cumulative. The higher rate of growth raises the elasticity of supply, which accommodates the unbalanced growth. A lower rate would present a more serious obstacle to unbalanced growth which in turn in this case would slow down growth. And the doctrine of balanced growth may well be more applicable to the initial stages of growth, though even there some arguments point the other way. For one of the objectives of development is precisely to raise supply elasticities. The pressures created by lack of balance may render factors of production, and particularly entrepreneurial decisions, more responsive to economic incentives.

Unbalance and Production

(*a*) *Indivisibilities*

The definition of balanced growth, it will be recalled, is simultaneous investment in several industries in conformity with the pattern of consumers' demand and of different industries' demand for each others' products. But for many economies without large markets, investment that meets these criteria will be below the size that would allow optimum use of equipment. Given the demand curves at that income level, price would have to fall to such an extent that losses would be incurred if production were to take place at the lowest cost point. But an outward shift of the demand curves (a distortion of the pattern of consumers' demand) enables the output to be absorbed. The gradual growth of income raises the demand curves and removes, in due course, the initial distortion.

Assume five different products.[1] Each is produced by a plant with a capacity of 20,000. Assume that the gross accretion of annual demand occurs at the rate of 20,000 for each product, i.e. 100,000 in total. Assume further that the technically optimum plant has a capacity of 100,000. Balanced growth requires the installation of five sub-optimum plants of 20,000 every year, unbalanced growth the installation of one optimum plant of 100,000 each year. But in this case demand might have to be temporarily distorted, or excess capacity would have to be carried, although

[1] The illustration and the argument are taken from T. Scitovsky, 'Economies of Scale, Competition, and European Integration, *American Economic Review*, Mar. 1956. I am also grateful to Professor Scitovsky for illuminating discussions.

after 5 years balance can be restored at a higher rate of growth. If we assume constant relative prices, or zero elasticity of substitution, excess capacity and shortage of supply would be 80,000 in the first year, 120,000 in the second and third years, 80,000 in the fourth, and balance could be restored in the fifth year.

It might be objected that the above 5-year plan is really a plan for balanced growth, only the time-period of balance is 5 years instead of 1 year. Since perfect simultaneity of complementary investments is impossible, we must try to average out over a period.

To this defence of the doctrine of balanced growth there are two replies: First, granted that ultimate balance is the aim, the doctrine leaves the period over which it is to be achieved ambiguous. It is possible to reformulate the choice between balance and imbalance in terms of choice between balance over periods of varying lengths. But the point is that there is such a choice, and the doctrine of balanced growth is either biased in favour of short-period balance or ambiguous.

Secondly, balance need not be aimed at after 5 years. A new 5-year plan for unbalanced growth may be put up, say for plants of 500,000 capacity, and so on, as long as economies of scale exist, so that balance is in fact never achieved. It does not appear that the concept of average balance is at all helpful here. Balanced growth, in such a situation, is neither correct as a method of procedure, nor as an ultimate objective.

We thus see that where economies of scale are important and the optimum size of equipment large, the situation is analogous to Wicksteed's piano player, faced with the choice of buying or renting a piano. It becomes a matter of choice whether balanced growth in the narrow, short-term sense or greater economies of scale are desired. A plan directed at the full exploitation of economies of scale will be a plan for unbalanced growth. The choice lies between (1) a current sacrifice, in the form of distortion of demand[1] or shortage combined with surplus capacity, for greater cost reductions in the future, and (2) optimum current use with higher costs later. We have to strike a balance—or rather an imbalance—between these two objectives.

> A system—any system, economic or other—that at *every* given point of time fully utilizes its possibilities to the best advantage may yet in the long run be inferior to a system that does so at *no* given point of time, because the latter's failure to do so may be a condition for the level or speed of long-run performance.[2]

[1] To say that distortion of demand entails a loss implies that the consumers' choice of the five products is not (*a*) irrational, (*b*) the result of habit, (*c*) due to other consumers' demanding these products, (*d*) due to lack of opportunity to choose between, on the one hand, the five products, and, on the other, fewer varieties at lower prices. If any of these assumptions is violated, concentration may not only yield gains in the future, but would impose no current sacrifice.

[2] J. Schumpeter, *Capitalism, Socialism and Democracy*, p. 83.

In principle, the optimum amount of current distortion or under-utilization combined with shortages, is determined by the time-preference of the community. If over-investment is defined as 'failure to attain the ideal distribution of the community's income of consumable goods through time'[1] the plan for unbalanced growth need not imply over-investment. But even in theory, the ideal distribution through time is an ambiguous concept, and in practice all that can be said is that it must be a political decision—even if only the decision to let the existing income and property distribution settle the matter through the market forces. A market economy too can achieve a higher rate of growth than would be warranted by the doctrine of balanced growth. It can do this in a variety of ways.

First, over-expansion may lead to price reductions which, however, still allow total costs to be covered. Even where a competitive industry may not be able to cover costs, a discriminating monopoly may do so. All this is still compatible with the doctrine of balanced growth, which need assume neither constant prices nor competition. But an investment may be socially justified though it cannot recover all costs even by discriminatory pricing.

Secondly, advertising and other selling efforts may be used in order to switch demand into the lines in which expansion has occurred. Such distortions facilitate development and modernization. If successful, such efforts may be justified in the interest of growth. The higher the standard of living already attained, the easier it is to cajole demand into the new channels, partly because demand is more diversified because the new goods are not likely to be necessities, partly because there will be in any case the attraction of novelty.[2] An underdeveloped economy may have to use other methods than sales efforts to direct demand, e.g. discriminatory taxation and controls.

Thirdly, unexpected losses may be suffered and may be symptoms of unbalanced growth in a market economy. Those who over-optimistically over-estimated the chances of success will find that they have suffered losses, although the capacity created by them survives to serve higher production later than would otherwise have been possible. The losses during the railway mania are an outstanding example. But there is reason to suppose that an element of this is usually present. It is not those who calculate coolly the prospects of an investment who form the

[1] D. H. Robertson, *A Study of Industrial Fluctuation*, p. 180.

[2] It is easier, and less harmful, for a rich man to eat, if necessary, strawberries without cream, than for a poor man to eat chips without fish. On the other hand, certain things that do not go together in a poor society become strongly complementary as the society advances, e.g. plumbing and houses. Strength of complementarity is partly a matter of habit. 'Invention is the mother of necessity' as Veblen observed (A. O. Hirschman, *The Strategy of Economic Development*, p. 68). This is true not only of consumption but also of production. See below, p. 181.

entrepreneurial class, but the over-sanguine, who over-estimate their ability, their luck and the prospects.

The mere fact that the lines built during the railway mania have not been torn up but are still used, although interest charges have been discarded, does not, of course, prove that the investment was socially sound.[1] It might have been better had the capital been put into some other project. On the other hand, it is quite possible for the lines to be run at a loss (even if a perfectly discriminatory price policy were pursued) for a considerable time, and yet for the eventual growth in demand to be sufficient to yield interest on the principal, on the interest re-borrowed, and on any extra capital borrowed to finance losses. Even if the lines should never earn sufficient income to pay these compounded charges, so that losses are permanent, they will have yielded external economies in the form of lower costs or higher demand for the products of other enterprises. It is true that they, in turn, may, after a time, reap some of the external economies of those enterprises that benefited from them. Lower transport costs will reduce the price of steel and lower the costs of railway construction. It is also true that there may be diseconomies. Nevertheless, if default occurs before the ultimate gains have had time to accrue, or in conditions in which sufficient net gains accrue to other enterprises, the investors have made (socially) correct decisions, though they do not reap the rewards.

In so far as it is merely a matter of waiting long enough (rather than a matter of external economies), the obvious solution would appear to be to finance these projects by adequate loans with distant maturity, or by repeated re-borrowing. But only lenders with distant time horizons would be willing to supply the capital. The span may reach beyond one generation. Moreover, in so far as the gains accrue, temporarily or permanently, to other enterprises, the full benefits can never be recouped by the industry in question.

In an economy which does not rely entirely on *laissez-faire*, there is a choice between forcing demand into line as described above, and subsidizing losses resulting from low prices or excess capacity. If the subsidies are financed by taxation, something is forgone in other directions by the taxpayers. The policy is sensible only if the ultimate benefits in cost reductions and external economies exceed the benefits derived from the expenditures which have to be sacrificed during the period of taxation

[1] The argument on this and the next page is developed by Nurkse in his second Istanbul lecture ('Some Reflections on the International Financing of Public Overhead Investments', pp. 22 and 25–28). But whilst he uses it to show that a *vertical* maladjustment (too much overhead in relation to direct investment) can be a stimulus to growth, the crucial requirement is that the investment should be *lumpy* (static setting) and *initiatory* (dynamic setting). Cf. below pp. 180 and 183.

plus subsidization. The same is true if the subsidies are financed by loans from abroad, unless the loans are tied to these projects, in which case their opportunity costs may be considerably lower. Whatever the method chosen, full exploitation of large-scale economies may involve a violation of the principle of balanced growth.

(*b*) *Dynamic complementarities*

The argument in the previous section has assumed a given rate of growth of demand, which can be pushed up by installing large-scale, underutilized, equipment. In reality, there will be several additional forces at work which determine the merits and drawbacks of excess capacity.

First, the advantages of building ahead of demand are not confined to economies of scale. Costs are incurred in expanding and rebuilding equipment from a smaller to a larger scale. Production may have to be interrupted, work done may have to be undone, &c. Such costs would not have been incurred if the initial outlay, instead of having been adapted to current demand, had been geared to a (future) larger demand.

On the other hand, however, it is possible that new inventions may become available, which make it appear wise to wait with heavy capital outlays. Building ahead has risks, as well as opportunities for economy.

Second, the accretion of demand may be due not only to the lowering of costs that resulted from the installation of large-scale equipment (the analogy of Wicksteed's piano player), but may be stimulated beyond that by the 'unbalanced' investment (the analogy of the swimming-pools). The construction of railways in the nineteenth century and the river development schemes in this century did not merely meet existing demand, but created new demand by encouraging a whole cluster of activities: settlements along the tracks in the former case, the growth of industries and improved agriculture in the latter. The demand that arises, eventually, as a result of the initially unbalanced investment is substantially greater than that due to cost reductions from indivisibility.[1]

Finally, there are repercussions on inventions and their application: just as in consumption new voids open up as we move along the path of satisfying existing wants, so investment that is intended to fill existing gaps may lead to innovations that open up new gaps. Historically, there can be no doubt that progress has been irregular and has generated imbalance of this type. Mr. A. J. Youngson has recently drawn our attention to the distinction between initiatory and consequential investment.

[1] In the ultimate paragraph of his Turkish lectures Nurkse suggests that the beginnings of civilization were made possible by overhead investment as a means of development. The construction of roads by the Romans led to the formation of colonies and the growth of trade, and the ancient river development schemes along the Nile, the Indus, and the Euphrates and Tigris made possible the division of labour between peasants and craftsmen, which is at the root of civilization.

> Investment . . . may well give rise to a chain of further investments whereby the initial investment is sustained, elaborated and supplemented. A classic case is the introduction of the motor car. Investment in plant to build cars gave rise to consequential investment in rubber plantations, steel presses, oil refineries, road-making equipment, petrol stations and so on.[1]

Schumpeter considered this kind of investment as the key to the understanding of economic growth. Progress depends upon the adaptation of passive sectors to the active sector in which innovations originate, i.e. on the attempts to restore balance once it has been destroyed, as well as on the disturbing innovation itself.

> Progress—in the industrial as well as in any other sector of social or cultural life—not only proceeds by jerks and rushes but also by one-sided rushes. . . . We must cease to think of it as by nature smooth and harmonious. . . . On the contrary, we must recognize that evolution is lop-sided, discontinuous, disharmonious by nature. . . . The history of capitalism is studded with violent bursts and catastrophes which do not accord well with the alternative hypothesis we herewith discard. . . . Evolution is . . . more like a series of explosions than a gentle, though incessant, transformation.[2]

We have no satisfactory explanation of the causes of technological discoveries and inventions. But it appears that scarcities and bottlenecks provided the stimulus to the inventions that revolutionized England's—and the world's—economic system, and that the inventions, in their turn, created new scarcities and bottlenecks. Necessity was the mother of invention, but invention was also the mother of necessity. On this succession rests the history of technical progress and the history of the anabolism of wants. Balanced development, had it been possible, would have reduced or even eliminated the incentive for discoveries, or at any rate for their application.

From the beginning of the eighteenth century, two bottlenecks hampered the balanced growth of production: timber and spinning. Timber was used not only for building ships and houses, but as fuel both in homes and in the production of iron. It was becoming increasingly scarce and imports were both expensive and subject to the uncertain trade policies of foreigners. The discovery of Abraham Darby eventually emancipated the furnace owners, and that of Henry Cort the forge-masters from their dependence on wood. Indirectly, timber shortage also led to the invention of the steam engine, as a method of pumping water out of coal mines. The new source of fuel and power enabled the iron industry to raise its output from 68,000 tons in 1788 to 3 million tons in 1855. It went far beyond breaking the timber bottlenecks and opened up a new era of investment opportunities.

Similarly, yarn had become scarce as a result of the improvements in

[1] 'The Disaggregation of Investment in the Study of Economic Growth', *Economic Journal*, June 1956, p. 240.

[2] J. Schumpeter, *Business Cycles*, vol. i, p. 102.

weaving in the beginning of the eighteenth century. The inventions of Hargreaves, Arkwright, and Crompton transferred within a few decades all spinning into factories and created a famine of weavers, which in turn led to the mechanization of weaving.

The wave of inventions which led to the Industrial Revolution originated in attempts to break through these two bottlenecks: to overcome timber shortage by coke, and shortage of yarn by the use of machinery. Similarly, the pressing need for power led to the discovery of the use of steam to produce rotary motion. Automatic welding, at a much later date, provides another example.

'Its rise originated in Admiralty needs. The vibration and shock due to gunfire used to work rivets loose, so that many of the rivet-holes in the bulkheads would cease to be watertight. Welding provided a joint which would remain completely watertight.' . . . the new process, which quickly proved economical of a particularly onerous type of labour, 'was then applied far more widely than the original extraordinary need would have suggested.'[1]

The idea that a big advance on a few fronts is more successful than small advances on many fronts simultaneously is supported by the remarkably high correlation between rates of production growth and rates of productivity growth in manufacturing industry.[2] This relation is not merely supported by statistics, but is also plausible (or the other way round). The expansion of an industry may be a condition for raising output per man hour, whilst diversification may impede progress. In so far as this is due to internal economies of scale, the point has already been covered. But it may also be due to external economies and to the fact that when capital equipment is being extensively increased technical improvements in both products and processes are facilitated.

We have seen that a case for unbalanced development can be made out if (i) indivisibilities are important, (ii) expansion costs are important, (iii) higher incomes are created than would be by balanced growth, and (iv) incentives to invent and to apply inventions are strengthened. On what principles then should one decide upon the order in which investment should be carried out?

Although the need for large fixed investment in social overhead equipment and its slow rate of obsolescence would suggest that it should always be used as the spearhead, other considerations point to different answers. Roads, railways, and river developments may not create sufficiently strong incentives to correct the unbalance which they create. One aspect of the case for unbalance is that it highlights the spots where action is needed most urgently, and thus economises in a resource often in short

[1] R. S. Sayers, 'The Springs of Technical Progress in Britain 1919–39', *Economic Journal*, June 1950.

[2] See Colin Clark, *Conditions of Economic Progress*, 3rd ed., pp. 363–72.

supply, viz. the power to take decisions.[1] It is therefore best to allow the pressures of unbalance to be exercised most strongly upon those who are most responsive to the signals and the incentives thus created. A keen political group in power may well provide the social overheads, hoping for response of a more sluggish private class of potential entrepreneurs. On the other hand, other societies may forge ahead in the development of the exploitation of some natural resource or some industry and thus create the pressures upon the government to develop transport and power.

The considerations that should guide the choice of investment priorities may therefore be summed up as follows: Choose projects which, (i) while advancing some sectors, concentrate the pressure of unbalance on groups and sectors whose response to a challenge is likely to be strongest; (ii) while creating bottlenecks, also break them; (iii) while providing products and services for industry, agriculture, and consumers, also induce new development to take place in other directions, directly and indirectly related to them; (iv) while providing a new product or service require consequential investments in other lines. Historical examples of (iii) are railway construction, power and raw material development. Historical examples of (iv) are the motor-car, the wireless, and the cinema.

The argument so far has been that unbalance may be a condition of and a stimulus to growth. Indivisibilities—whether of consumption goods or of productive equipment—and the cumulation of complementary wants or complementary technological needs may speed up growth or prevent stagnation. The justification for building ahead of demand can be found partly in technical indivisibilities, but more importantly in the cluster of complementary investments which it provokes. The concept of 'growing points', current in the literature on development, seems to express this fact. It appears to refer to a concentration of activities upon breaking through an obstacle in such a way as to give a strong impetus to a series of clustering activities, all promoting growth. Only if the forward flow of energy is impeded in all directions by a succession of bottlenecks (if this were logically admissible), and if the backward pull of the passive sectors is stronger than the forward push of the active sectors, is balanced advance indicated.

But there is another side to the argument against balance. Whereas I have so far attempted to put what might be called the strong case, there is also a weak case, although the combination of the two leads to an argument that is stronger than the sum of the two cases separately. Not only may unbalance result in growth, but growth may lead to unbalance. In so far as the two interact, the result is a cumulative process of advance, progress generating its own stimulus.

[1] Cf. Albert O. Hirschman, *The Strategy of Economic Development*, p. 63.

The second proposition by itself says simply that to insist on balance may slow down progress. This is the thesis of Mr. Wiles.[1] To say that progress is irregular does not imply that irregularity causes growth. Similarly, to say that if we step up the rate of growth we shall make more mistakes about the correct allocation of resources does not mean that we can speed up growth by making more mistakes. All Mr. Wiles says is that in order to get more rapid growth we may have to give up insisting on balance. It is possible to argue that unbalance is a necessary evil. Yet, we have seen that it can also be a source of strength. But if unbalance accelerates growth, the unbalance resulting from growth, far from being an evil, is a further stimulus. It becomes a powerful twist in a virtuous spiral.

Foreign Trade and Foreign Lending

The doctrine of balanced growth is commonly also used to justify diversification of industries or *national* balance.[2] This may well be the correct policy today for primary producing countries which are embarking on development, but has not always been the historical pattern that led to success.

The Industrial Revolution in England is an example of how lop-sided growth can lead to much more rapid economic progress than would have been possible, had investment obeyed the principle of nationally balanced growth. The innovations and the resulting rise in productivity were concentrated upon a few industries, mainly transport and textiles. Had it not been for two factors, the rise in productivity in textiles could not have led to the rise in the production of textiles that actually occurred. The workers set free would have had to be absorbed in activities such as agriculture, subject to rapidly diminishing returns (assuming that they would have been re-employed at all) and the net rate of growth would have been correspondingly smaller.

The two factors that made unbalanced excess production possible in England were foreign trade and foreign loans. The first provided a market, the second prevented the deterioration in the terms of trade that would have occurred, if exports had been sold only for imports. Between the end of the Napoleonic Wars and the outbreak of the American Civil War Britain's exports rose at a cumulative rate of 6 per cent. per annum. The ability to sell abroad the increased output for which there could have been no demand at home, without having to suffer a more substantial reduction of export prices, made a much higher rate of growth possible.

Two types of advantages followed from the concentration of investment in a few lines: First, internal and external economies of scale could be

[1] 'Growth versus Choice', *Economic Journal*, June 1956.
[2] Cf. F. List, op. cit.; R. Nurkse, op. cit., pp. 21, 84; W. W. Lockwood, op. cit., p. 228.

exploited that would have been absent had investment followed a more balanced pattern. Secondly, the rate of invention in those few lines, and the application of these inventions, was speeded up beyond what it would have been had there been greater dispersal. The inventions first in spinning—Hargreaves's jenny, Arkwright's frame, and Crompton's mule—followed by inventions in weaving—Cartwright's loom—and in the finishing processes were related to each other and stimulated by each other, partly because the application of each overshot the mark that would have been dictated by balance. These inventions and innovations were followed by the successful search for markets in which to dispose of the increased production.

In Germany, by contrast, growth was more balanced in the sense that innovations were dispersed over a greater number of industries, and foreign trade therefore played a smaller role.

It is, of course, possible to look upon export industries as industries producing indirectly what the foreign exchange will buy—now and later. In this way what would be lop-sided growth in the absence of disposal abroad can be regarded as balanced growth. But since the inventions came first and the search for markets was a response to them, and since a part of the foreign earnings were invested abroad, it is more natural to look at the course of events as unbalanced growth combined with attempts to shape the pattern of demand and trade, rather than growth that responds to a given pattern.

It clearly does not follow that diversification may not be the right policy for some developing countries today. Against the advantages of pushing ahead in a few lines must be set two possible dangers. One is a low price elasticity of demand for exports which would inflict terms of trade losses as production for export expands. The other is the possibility that demand for the developing country's exports may not be expanding rapidly in advanced countries, so that the terms of trade would deteriorate as incomes rise. Either a low price elasticity or a low income elasticity of foreign demand may justify a programme of nationally balanced investment.

Nevertheless, there is a case for unbalanced expansion also in those countries which are trying to catch up with the more advanced countries. The reverse situation of unbalanced expansion combined with foreign lending (Industrial Revolution in England) is borrowing from abroad in order to develop a spearhead sector which activates the rest of the economy. Railway developments in the U.S.A., Canada, Argentina, and Australia in the last century, and projects for river developments, power dams, afforestation, oil or other mineral extraction, or city building in this century fall into this category. As we have seen, not only technical indivisibilities and expansion costs may make building ahead of demand

economical, but unbalance of a certain type may speed up the growth of income and demand above what it would otherwise have been.[1]

In the past, such investment was often financed by default on foreign loans. But we have seen that this does not necessarily mean that the projects were faulty. Although individual investors' time horizons will be too narrow, publicly financed lending institutions should be expected to take a wider view. The application of strictly commercial criteria for sound lending policies does not mean that private lenders' time horizons ought to be accepted, or external economies neglected.

But it may be that the road to expansion both through an unbalanced increase in exports and through domestic spearhead development is closed: the former for terms of trade reasons, the latter because not sufficient capital from abroad is available. The choice then still remains between a domestically financed unbalanced expansion, and nationally balanced growth. Though foreign trade may fail as an 'engine of growth', inter-regional or inter-sectoral unbalance may provide a substitute.

Balance between Savings and Investment

The case for government responsibility to maintain aggregate equilibrium between savings and investment at full employment, and at a desired rate of investment, can be put in terms of the failure of the market system where complementarity is important. Decisions that should be taken simultaneously, if taken separately, may lead to waste—in this case the wastes of unemployment or inflation.

This similarity of principles has been either ignored or explicitly denied.[2] Thus Nurkse, in his Istanbul Lecture, says: 'A case for state investment may clearly arise if and when the mobilisation of capital supplies discourages private investment activity and so destroys the demand for capital. But *this case is entirely separate* from the principle of balanced growth as such.' (My italics.)

But the case is, at least formally, almost identical. Just as demand from producers in the investment sector is needed in order to offset the lack

[1] A recent illustration of conscious creation of unbalance for development is Brazil's new capital city. 'The second purpose of the new capital is to encourage development of the under-populated interior, which has vast resources waiting to be tapped. . . . It is hoped that the construction of a big city deep in the interior, with the markets it will create and the new movements of population it will stimulate, will start a far-reaching process of opening up the undeveloped areas. More significant even than markets and population are communications: it is chiefly the lack of communications that has held up the development of the interior. But already roads and railways link Brasilia with the coastal cities and—as important to the future development of the country—the new modern highway that leads to Brasilia is being continued northwards for another thousand miles, penetrating for the first time into the tropical jungle of the Amazon basin.' J. M. Richards, 'Brazil's New Capital City', *The Listener*, 13 Nov. 1958, p. 772.

[2] A notable exception is the *Economic Survey for Europe in 1955*, and the publication of the American FoL–CIO. See footnote 5 on p. 172.

of demand for consumption goods caused by saving, so demand from the producers of bread for shoes is needed in order to offset the lack of demand for shoes caused by shoe-producers not spending all their incomes on shoes. Furthermore, just as an increase in consumable output must produce a balanced diet, so the extra output must fit the community's decision as to how to divide its resources between present consumption and larger consumption in the future. It is part of the requirement of a balanced diet to provide for the same or improved consumption later. There is no difference in principle between the decision as to how much bread and how much butter, and the decision as to how much consumption and how much saving. The same principle applies to decisions relating to savings and investment as applied to decisions relating to investment in different industries. But here again, a lack of coordination, an unbalance, *may* provide a stimulus to growth. I shall briefly mention two cases: a free market economy, and an economy attempting to raise its rate of savings and investment.

(*a*) *The market economy: investment exceeds profitable investment*

As we have seen, one aspect of balanced growth is the balance between productive capacity and consumption. The E.C.E. *Survey* defines balanced growth 'as a development in which the growth of consumption matches the growth of productive capacity in the consumer-goods sector. This definition, while not implying any particular rate of growth, does mean that consumption at any particular time is great enough to keep up the incentive to invest.'[1]

Yet, investment that is unbalanced on this definition can lead to a higher rate of growth than balanced investment. Mr. Kaldor expresses this possibility:

> The conclusion which emerges . . . is that so far from the trend rate of growth determining the strength or duration of booms, it is the strength and duration of booms which shapes the trend rate of growth. It is the economy in which businessmen are reckless and speculative, where expectations are highly volatile, but with an underlying bias towards optimism, where high and growing profits are projected into the future and lead to the hasty adoption of 'unsound' projects involving over-expansion, which is likely to show a higher rate of progress over longer periods . . . the extent of the 'over-expansion' in the previous boom influences to a major extent the degree to which the new boom surpasses the peak reached by its predecessor.[2]

[1] *Survey for 1955*, p. 76. See footnote 5 on p. 172.

[2] Kaldor, 'Economic Growth and Cyclical Fluctuations', *Economic Journal*, Mar. 1954, pp. 68–69. However, tucked away in a footnote on p. 62 is the assumption that the consumption function shifts upwards in time (or that autonomous investment grows at the trend rate), so that the trend ultimately depends upon the trend, not simply on the cycle. But for the present argument this makes no difference. It is the temporary disequilibrium that, later, makes possible a higher trend.

Mr. Kaldor is saying here that an excess of investment over savings, though destabilizing, is a force for expansion in an unplanned economy. When demand strains against capacity, more capacity may be created than is needed to accommodate demand. The principle of balanced growth is violated. This leads to the downturn. But in the next boom more demand can be accommodated, if the surplus capacity created in the last boom has been in the right places, i.e. where there is a potential demand for it. The service that was rendered by a diversion of demand in the case of new industries with large-scale economies[1] is now rendered by buoyant entrepreneurial spirits. Had there not been over-expansion in the previous boom, the higher demand, resulting from the upward shift in the consumption function, could not have been satisfied in the succeeding boom. To build ahead of demand is one way of assisting in the achievement of a high secular rate of growth of output.

To reverse a dictum of Sir Dennis Robertson's, what turns out to be over-investment in the sight of man, may not be over-investment in the sight of God.[2] A better distribution of society's income through time may be achieved, at the cost of fluctuations, by this type of over-investment. As Sir Dennis Robertson wrote on the last page of his *Study of Industrial Fluctuation*: 'Out of the welter of industrial dislocation the great permanent riches of the future are generated.'[3]

More recently, Mr. Kaldor has developed another argument for a certain kind of unbalanced growth.[4] A certain rate of inflation (i.e. imbalance between total saving and total investment) may be necessary in order to achieve a given rate of investment. If the rate of inflation were reduced relatively to interest rates, the distribution of income would change in favour of wage earners and against profit earners. This in turn would reduce investment. In other words, if investment is a function of the share of profits, and if other methods of redistribution are inadequate, prices that rise in relation to money wages are the only way in which higher investment can be achieved.

(*b*) *The progressing economy: desired investment exceeds private savings or private investment*

Complementarity between investment and the consumption generated by it would seem to indicate the need for balance between rising investment and consequential consumption. Clearly, only those who believe that the rate of saving should be governed by free consumers' choice

[1] See above, pp. 176–7.

[2] It will be seen that this is not over-investment on Robertson's own definition. See above, note 1, p. 178.

[3] p. 254.

[4] N. Kaldor, 'A Model of Economic Growth', *Economic Journal*, Sept. 1957.

expressed in the market would accept this balance. It seems to be, for example, the view of P. T. Bauer and B. S. Yamey.[1] Such a policy would involve a budget which is always balanced. The pursuit of full employment would have to rely solely on monetary policy.

But it is difficult to see why the rate of capital accumulation and of full employment saving should be determined by the market mechanism. In a democracy, the rejection of this principle does not imply paternalism or reduced freedom of choice, but, to use the jargon, merely a reduced weight given by ourselves to our own individual indifference curves between present and future consumption, either because we distrust our current impulses, or because we consider that our tastes may change in time, or because saving for investment is looked upon as a collective want for which each of us is ready to make sacrifices to the individually desired extent only if others—and hence also we—are *forced* to contribute the proper share.

In this sense any budget surplus planned to provide savings for a higher rate of investment than the market would yield is a plan for unbalanced growth. The incomes generated by investment are not allowed to be fully spent on consumption. The poorer a country and the keener it is on development, the less balanced its plan can afford to be. All development programmes are programmes for unbalanced growth in this sense.

Somebody might possibly object that this is extending the meaning of the doctrine of balanced growth beyond permissible limits. Yet the case for altering the composition of consumption and industrial output by means of taxes and subsidies to suit the objective of growth is surely merely an extension of the principle that incomes should be taxed to provide savings for investment.

Similarly, private investment may be inadequate in a private enterprise economy. When the means to invest are there, because consumption is low and factors of production are idle, the incentive is missing; when the incentive is there, because consumption and its rate of increase are high, the means are often inadequate. The case for state investment then is the case for cutting the link between consumption and investment and making investment autonomous, or unbalanced. This would be justified if the socially desirable rate of investment exceeded the investment carried out under private enterprise in obedience to the dictates of balance (viz. the accelerator in some form), and if manipulating the market mechanism (by fiscal and financial policy) could not achieve the results.[2]

In 'A Soviet Model of Growth'[3] Evsey Domar discusses and reinterprets

[1] *The Economics of Under-developed Countries*, p. 153.

[2] This point was made by Nurkse in his first Istanbul lecture (p. 11) and in private correspondence where he again insisted on 'the importance of distinguishing between the vertical and the horizontal order of things.' Cf. above p. 186.

[3] *Essays in the Theory of Economic Growth*, chapter ix.

a model in which the division of investment between the capital and consumer goods industries determines the rate of growth. The complementarity between savings and investment is eliminated by (*a*) eliminating any limitation on production other than capital, and (*b*) determining the ratio of investment to income by the relative capacities of the two sectors. As a result, the *allocation* of the investment thus determined between capital and consumer goods industries becomes the active force which provides the impetus of growth. The higher the ratio of investment allocated to the capital goods sector (i.e. the greater the unbalance), the faster will be the rate of growth of income, and, subject to a few qualifications, also of consumption.

Summary

The case against balanced growth is twofold: First, in some conditions lack of balance promotes growth. Secondly, in order to get growth, one may have to sacrifice balance. Unbalance can be a condition of and a stimulus to growth; or it can be the result of removing obstacles to growth. But the combination of these two arguments can yield a powerful mixture. Unbalance stimulates growth, which leads to new unbalances and further stimuli.

The relevant division here is not so much between adherents of the market economy and planners, for both balanced and unbalanced growth can, in principle, and if considered as objectives rather than procedures, be achieved by either type of system. Balance can be achieved, in the end, by successive adaptations following the signals and incentives of the price mechanism, though it must involve waste compared with a balanced process towards the goal of balance. Unbalanced growth, though it may justify the use of prices as signals and incentives, may also be more successfully pursued by planning, because surplus capacity has to be carried, because temporary losses will be incurred, and because private sights are too short.

If the road, or rather the plain, to progress is studded with obstacles, both in width and in depth, and if the removal of obstacles pushes the advance forward by less than the remaining obstacles retard it, balanced advance is advisable. If, on the other hand, obstacles, though serious, are few or of unequal strength, and if overcoming one releases forces that carry advance further, unbalanced growth is more promising.

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ARGUMENTS FOR TARIFFS[1]

By J. BLACK

1. The purpose of this paper is to give a brief summary of the possible arguments in economic theory for the imposition of tariffs or export duties, or the adoption of methods such as multiple currency practices which have analogous effects. It will discuss the circumstances in which such arguments are likely to be valid, and will draw attention to the type of factual knowledge required to make sensible decisions about tariff policy possible; but no attempt will be made to assess the merits of the actual tariff policy of any particular country, or to expound the details of precise mathematical models of the cases under discussion.

2. Certain warnings must be given about the simplifying assumptions which are made in the following analysis; one of these is that the various possible motives for tariff policies will be discussed on the assumption that they operate separately. This is of course unrealistic; tariffs are supported and opposed by political coalitions of divergent interests and beliefs, and a given measure may be supported for a variety of reasons; even the same supporter of a tariff may believe it serves several desirable ends. For analytical purposes, however, it is desirable to consider the arguments one at a time.

3. A second warning is that when the effects of the presence or absence of a given tariff are analysed below, it will be assumed without specific warning in each case, either that the argument is a pure exercise in comparative statics, or that where there is an actual process of change from one position to the other this is assumed to happen sufficiently gradually, or with sufficient notice, for the economic system to be able to absorb it without the change in question setting off a chain reaction of instability. However beneficial or injurious may be the long-run effects of the adoption or abandonment of a tariff policy in easy stages and with fair warning, the effects of the sudden imposition or removal of a tariff may well give rise to considerable unfairness and economic waste. The fact that the sudden and total alteration of a mistaken policy may give rise to undesirable consequences should not, however, be taken as an excuse for complete inaction.

4. The reasons which induce governments to adopt tariff policies may be divided into three broad classes. First, they may be intended to affect the distribution of incomes; second, they may be intended to

[1] The author is indebted for comments and suggestions to Sir G. D. A. MacDougall, Dr. W. M. Corden, and Mr. J. Bhagwati, who are not, however, responsible for the views expressed.

affect the degree of utilization of a country's resources or its balance of payments; third, they may be intended to affect the composition of production or consumption. Each of these broad classes of motive may be considerably subdivided, as is done below. In each case a policy adopted from one motive will probably have some by-products which a government affected by a different motive would have deliberately sought or shunned; in general these by-products will be ignored rather than assumed to be zero, but in the case of changes in employment or the balance of trade this is not permissible, and it is assumed that such changes do not occur except in the case of tariffs imposed for these express objects. In the case of tariffs imposed for motives of the first and third classes, it is assumed that relative prices change in whatever manner is necessary to keep the level of employment and the balance of trade unaltered. (This implies, in terms of model-building, that it is 'real' models which are relevant to motives one and three, and 'monetary' models which are relevant to motive two.)

5. The main sub-divisions of the income-distribution objective of tariffs are (1) to transfer income from other people to the government imposing the tariff; (2) to transfer real income from foreigners to the subjects of the government imposing the tariff; (3) to alter the distribution of real incomes amongst the government's own subjects. The revenue motive is both historically and currently extremely important; but even for a government which, like a robber baron imposing tolls, is unconcerned with the losses the tariff imposes on other people, there is a limit to the height of the tariff it pays to impose. A prohibitive tariff, i.e. one sufficiently high to prevent any trade in the goods concerned, will bring in no revenue. Besides this, the long-run maximum revenue tariff is likely to be lower than that which would yield most at the time when it was first imposed. This is because with a zero tariff, factors of production will have tended, both at home and abroad, to adapt themselves to the pattern of location of production and consumption most appropriate to free trade. The imposition of a tariff will tend to lead factors of production in each country to move from export into import-competing industries; but this movement will take time, and while it is still in progress, any given tariff will tend to yield more revenue than when the process of adaptation is complete. Thus in setting a maximum revenue tariff, as in setting any monopoly price, it is necessary to take account of the movements of factors of production which this will induce in the long run; these will tend to make a long-run maximum revenue tariff lie below the short-run level.

6. To see why governments rarely do attempt to set their tariffs at maximum revenue levels, it is necessary to consider the effects of tariffs

on other people. The actual revenue collected of course represents a loss to whoever bears the real incidence of the tariff; but it is legitimate to disregard this, since if the revenue derived from tariffs were reduced, the government would either have to reduce its expenditure, to increase some other form of taxation, or resort to deficit financing, which will eventually produce similar results via inflation; and each of these alternatives has its own economic and social costs. The loss to other people is not confined to the actual revenue collected, however; if a tariff has to be paid on goods passing national frontiers, some commodities will not be traded at all, while others will be traded in smaller quantities than under free trade. Being made to forgo the gains which would have been made on this trade imposes a loss on other people over and above the revenue the government receives. Thus if these losses fall on its own subjects, even a government entirely unconcerned with their welfare will have an incentive to avoid reducing their capacity to pay other taxes. It must be remembered, however, that other forms of taxation also give rise to losses to other people over and above the revenue collected.

7. To allow countries to obtain the maximum advantage from specialization it will usually be necessary for them to adapt their productive resources to the specific forms best suited to export production. This will only be done to the extent that it is justified by the long-term prospects of permanent access to export markets; thus fears about the future imposition of tariffs will serve to prevent the potential gains from trade being fully realized in the same way as an actual tariff would have done. International agreements not to raise tariffs may therefore confer positive benefits, and not merely prevent a deterioration in welfare, as might at first sight appear.

8. Though the revenue objective is important in tariff policy, the maximum revenue objective is not. Governments do in fact normally take account of the effects of their tariff policies at least on the welfare of their own subjects. Thus the second branch of the income distribution motive for tariff policy concerns the redistribution of real incomes in favour of a government's own subjects at the expense of foreigners. This is possible if the rest of the world does not present an infinitely elastic demand for the country's exports, and an infinitely elastic supply of its imports. (In a model-building treatment these are usually combined in an 'offer curve' showing the amount of trade the rest of the world would be willing to do at any given terms of trade; for purposes of exposition, as distinct from proof, of the optimum tariff argument this is not necessary.)

9. If the elasticities of supply and demand in foreign markets for a country's imports and exports are infinitely high, either because the goods concerned are in perfectly elastic supply and demand in the foreign

market as a whole, or because world markets are very large relative to the size of the country's foreign trade, then a tariff will merely serve to restrict the amount of trade, leaving the terms of trade unaffected. Any revenue obtained in this case is at the expense of home producers of exports or consumers of imports, who also suffer an additional loss through the reduction in the quantity of trade caused by the tariff. If the rest of the world does not present infinite elasticities, however, then as a tariff or export duty restricts the amount of imports the country imposing it will demand, the terms of trade will move in its favour. A tariff, by reducing the amount of trade, will always cause some loss of real income in the world as a whole, measuring real incomes in terms of the prices prevailing before the tariff was imposed; but where the foreign supply and demand curves are not perfectly elastic the foreigner will bear at least part of the loss, as his terms of trade will worsen. The home country's net gain from the tariff must be less than the improvement in the terms of trade times the quantity of trade, because of the losses of producers' and consumers' surplus on the part of the trade which is prevented by the tariff.

10. An 'optimum tariff' policy is one designed to maximize the real income of the country imposing it by so adjusting the tariff that any extra gain on the terms of trade which would result from a further increase in the tariff just balances the losses due to a further restriction of the volume of trade. Thus if a country imposes an optimum tariff the loss the foreigner is made to bear must be more than the loss of real income in the world as a whole. This analysis is similar to, but not identical with, the argument that a tariff is justified if 'the foreigner pays the tax'; the foreigner does indeed 'pay tax' to the extent of the change in the terms of trade multiplied by the quantity of trade remaining after the tariff is imposed; but because of the decrease in the amount of trade the foreigner's total loss is greater than the amount of tax he pays.

11. When the tariff is at the optimum level, any further increase will lower the amount of trade, whether it is measured in terms of imports or exports. When a tariff is first imposed, however, this need not be true; if a country forms the chief market for the goods it imports, or provides a major part of the total world supply of the goods it exports, it may actually find that the foreign elasticities of supply of its imports and demand for its exports are so low that it is actually possible to obtain more imports for less exports as the result of imposing a tariff. So long as this is true, however, it must pay a country to increase its tariff a step further; while at the optimum tariff, a further increase in the tax rate decreases the amount of foreign trade, whichever way it is measured.

12. It must be realized that talk of 'a tariff' is an extreme simplification. If goods of various types, with different elasticities of supply and demand,

enter into international trade, then a revenue-maximizing government is in the position of a discriminating monopolist, and it will pay it to impose a differentiated tax structure, which taxes relatively heavily goods with low supply and demand elasticities, and taxes goods with high elasticities relatively lightly. If it could be assumed that the supply and demand curves for different types of imports were independent, then a knowledge of the direct supply and demand elasticities for each good would be sufficient to allow a maximum revenue tariff structure to be calculated. However, if different imports are substitutes for one another in consumption, and different exports are produced by similar factors of production, then the calculation of a maximum revenue tariff structure would demand a knowledge of the 'cross-elasticities' expressing these indirect connexions. As the unambiguous statistical measurement of even direct elasticities in international trade has not yet been achieved, a detailed knowledge of the cross-elasticities is unlikely to be available in the foreseeable future. Thus any attempt at a maximum revenue tariff could discriminate between different classes of goods only in an extremely rough and ready way. Similarly a government trying to devise an optimum tariff structure would need to discriminate between exports with different foreign elasticities of demand and imports with different foreign elasticities of supply. In this case the home elasticities are irrelevant, since by hypothesis the government is not interested in gaining revenue at the expense of its own subjects. As in the case of a maximum revenue tariff structure, any very precise adjustment of tariffs to form an optimum structure would demand a detailed knowledge of cross-elasticities which is not in fact available.

13. A further complication which must be mentioned is that since tariffs and export duties can also be applied by foreign governments, any government setting tariffs must take account of other governments' tariff policies. If these can be taken as given, then their effects on supply and demand in foreign markets can simply be treated, like transport costs, as a natural feature of the world economy. The foreign tariff is not just 'given', however; changes of tariffs may be made for terms of trade, or other reasons, by more than one country. Thus any movement in the terms of trade caused by the imposition of a tariff by one country may be reversed by similar action abroad. If foreign governments are liable to change their tariff policies as a result of the actions of the home government, this places the home and foreign governments in a relation of oligopoly. Whether or not it pays foreign countries to impose tariffs on trade with the home country depends on the elasticity of the home country's demand for imports and supply of exports; if these are less than infinite, which is almost bound to be the case, then it would pay the rest of the

world to impose a tariff. This simple analysis is complicated by the fact that the rest of the world is not a single political unit, but a collection of countries all pursuing separate policies. If each foreign country put a tariff on all its trade, with other foreign countries as well as with the home country, the losses foreign countries would suffer as the result of decreasing their trade with each other would probably outweigh any gain they might make on their terms of trade with the home country. Thus no country is likely to face foreign tariffs as high as would occur if the rest of the world was in a position to combine to exploit its joint monopolistic advantage.

14. If countries discriminate in their tariff structures between goods from different suppliers, as well as between goods of different types, this creates a position of bilateral monopoly between each pair of countries; only in this case is it possible to identify retaliation to any particular tariff change. It does not necessarily pay any country to raise its tariff on another's goods merely because the other's tariff has been increased, however; apart from motives of bluff, which in general renders the analysis indeterminate, or of revenge, which can hardly be fitted into an economic analysis at all, retaliation pays only if the imposition of a tariff by one country makes its own elasticities of supply and demand lower at the new point of equilibrium in international trade than they were at the old one.

15. When all countries impose tariffs, it must be pointed out that whereas the effects of different countries' tariffs on the terms of trade tend to offset each other, the losses to each country due to restrictions on the volume of trade are cumulative. Thus there is a high probability that the equilibrium, i.e. deadlock, reached when retaliation is complete will leave all countries worse off than they would have been under free trade. This is not certain to apply to all countries, however, since some may be in exceptionally strong monopoly positions in their import and export markets, so that they still gain in the final position after retaliation. It has sometimes been suggested that it would pay all countries to agree to abstain from imposing tariffs, or even that the dissidents should be compelled to abstain. Quite apart from the political difficulties involved in reaching any such agreement, and the objections to compulsion, the point is soundly based even in theory only if it is assumed that all countries' tariffs policies are in fact adopted for terms of trade reasons. That this is clearly not the case can be seen by going on to examine some of the other arguments for tariffs.

16. Before proceeding to these it is as well to clear up two minor points. First, it can be shown that the objectives of tariffs and export duties can equally well be pursued by the use of multiple exchange rates. If foreign exchange transactions are not all conducted at uniform rates, where foreign currency required to pay for imports is sold by the ex-

change control authorities at a higher price than that at which they buy the foreign currency proceeds of the sale of exports, this has the same effect as a uniform tariff on all imports. If different selling rates are charged when providing foreign currency for the purchase of different types of imports this corresponds to a system of differential import duties; if different buying rates are applied to the foreign currency proceeds of the sale of different types of exports, this corresponds to a system of differential export taxes.

17. It is of interest, also, to notice that the effects of import duties and export taxes are more similar than might at first sight appear. If a country imposes a uniform rate of duty on all its trade, including 'invisible' items, then it does not matter in principle, so far as the long-run equilibrium position is concerned, whether this takes the form of a tax on imports, on exports, or some combination of the two. A tariff or an export duty will each produce a discrepancy between the relative prices of imports and exports abroad and their relative prices at home, and the effects of such a tax, whether on the real income of producers of exports, of consumers of imports, or of foreigners, will be just the same whether the nominal incidence of the tax falls on the importer or the exporter. This is obscured when the matter is considered in terms of percentage rates of duty only by the conventional mode of calculating the rate of an import duty as a percentage of the landed price excluding the duty, and the rate of export taxes as a percentage of the price of exports including the duty; thus a '25 per cent.' tax on all imports has effects exactly similar to those of a '20 per cent.' tax on all exports. Where it is desired to discriminate between goods with different supply or demand elasticities, however, this formal equivalence of import duties and export taxes disappears, since only import duties can discriminate effectively between different types of imports; and similarly for exports. A government which imposed a system of discriminating charges on imports and exports would still find, however, that for either maximum revenue or optimum tariff purposes an all-round rise in import duties would make necessary an all-round cut in export taxes, and vice versa. It must be recognised, also, that the monetary effects of import and export duties are not the same. Import taxes tend to raise the level of home relative to foreign prices, whereas export taxes lower home prices relative to those abroad; thus a change-over between the two systems would require adjustments in the relative levels of prices in the home and foreign countries.

18. The third class of income-distribution motive for tariff policy is to redistribute real incomes within the country. This may be done via its effects on home consumers, if different classes of society spend different proportions of their incomes on imports, or buy imports of different types

where imports are not taxed at a uniform rate. Analogous arguments apply to the consumption of goods which could be exported. Where this type of motive is the sole reason for high duties on, say, luxury imports, it can be argued that a tax on their consumption would be more appropriate. If local production is impossible, then changing the description of the tax would make no real difference, but if local production is possible, then import duties imposed solely for the sake of their effects on relative prices to consumers will tend to bring about an undesirable misallocation of resources, as they create an incentive to increase the local production of the taxed commodity. When the effects of a tariff on any one consumer good on the local production of substitutes are allowed for, the argument against using tariffs for this particular purpose becomes still stronger.

19. The tariff may, however, be intended to affect the distribution of real incomes between different classes of workers, between the owners of different types of land or capital, or between workers and owners. These different classes may be very broad or very narrow groups. The typical broad-group case is that of a country where one productive factor—say labour—plays a relatively large part in the production of the type of goods which are imported, or their close substitutes. This will normally imply that the factor is relatively scarcer in the country concerned than in the rest of the world. If a country's imports thus tend to have a high labour-content, a tariff will tend to increase the share, both absolute and relative, of the national income going to labour. If the tariff imposed is an optimum tariff, labour's gain need not (but may in fact) be at the expense of an absolute reduction in the incomes of other factors of production; but any increase in the tariff beyond this point will tend to help the scarce factor only at the expense of a larger loss to the other factors.

20. The typical narrow-group case arises where there is one factory, or one mine, making a particular product domestically. Here a tariff on the imports of this particular good, or of close substitutes, increases the profitability of the particular enterprise, and the earnings of its employees unless labour is perfectly mobile. The employers and workers in the protected enterprise thus gain jointly at the expense of other members of the community. The costs fall largely on the consumers of the goods concerned, but also on groups deprived of export markets by the restriction of imports. So long as the tariff does not exceed the optimum tariff, the gains will outweigh the losses; but any increase in the tariff beyond this level will impose losses on other members of the community exceeding the gains of the specially favoured narrow group; a tariff protecting a narrow group is particularly likely to be above the optimum level. As the benefits from such a tariff are concentrated and obvious, however, while the costs are

widely spread and in some cases not so obvious, in political terms the narrow-group type of tariff is notoriously difficult to remove.

21. The second major class of motives for tariffs is that concerned with their use to affect the balance of trade and level of employment. As these objectives can be pursued by other means also, especially by monetary, fiscal and foreign-exchange rate policies, it is necessary to compare the effects of tariff variations with the use of other means of achieving the same objectives. To isolate the effects of tariff policy from those of fiscal policy it will be assumed that sufficient of its tariff revenues are spent by the government to keep the community's savings propensity, including the government's own savings, unaltered.

22. A rise in the tariff rate tends to divert demand, at any given level of national income, from imports on to other goods; this is obviously true in the case where the demand for imports is elastic, in which case consumers have more left to spend on home-produced goods; but it still holds even when the demand for imports is inelastic, as in this case the tariff must originally have been below the maximum revenue level, and the government will gain revenue. On the assumption that savings do not increase, purchasing power will be diverted to the goods on which the government spends its extra revenue, or on which those who receive extra transfer payments, or remissions of taxation, spend the money. Only some fraction of this spending is likely to go on imports, so that when a tariff is imposed a larger proportion of total expenditure goes on home-produced goods and a smaller proportion on imports. Thus with any given level of autonomous expenditure—investment, for short—in the country, a larger proportion of the multiplier effects will tend to be generated at home and a smaller proportion abroad. If the country starts off in a position of less than full employment, total incomes at home will tend to rise.

23. Like other forms of 'beggar-my-neighbour' remedy for unemployment, tariffs tend to injure other countries by lowering their levels of income and employment, and are thus liable to provoke retaliation, or to compel defensive measures which have similar effects to deliberate retaliation. A balance of payments surplus created by tariffs does, however, leave room for expansion in the level of domestic investment, which tends to increase incomes at home still farther, and also to restore the volume of imports, and therefore the incomes of the foreign countries. If the domestic expansion in the home country is great enough to cause an increase in imports as large as the fall due to the tariff, total home demand for imports may not fall, and the incomes of the foreign countries need not suffer at all. In this case, however, the tariff tends to restrict the amount of international trade below the amount which would have taken

place if the home country's incomes had risen to the same extent, but external balance had been preserved via a fall in relative prices in the expanding country, or a devaluation of its currency. For foreign countries the tariff is worse in all respects; they do less trade, and on worse terms, if the expanding country relies on tariffs than if it had relied on devaluation or price movements to keep its trade balanced. For the expanding country the rise in tariffs is better for the terms, but worse for the extent of trade, than the other methods of preventing expansion from worsening its balance; as seen above, once the optimum tariff is passed the losses outweigh the gains from any increase in reliance on tariffs.

24. It is often argued that tariffs, or other methods of restriction of trade, are justified when a country has suffered a serious loss of export markets or rise in its need for imports, and devaluation would involve a serious worsening of the terms of trade. This cannot be true for an increase in the tariff above a certain point; a country cannot prevent a fall in its real income by refusing to allow the terms of trade to worsen. A country fallen on hard times will of course have an increased incentive to make sure that it really is pursuing an optimum tariff policy, as it is less well able to afford the cost of mistakes; but its tariff may well have been above the optimum level to start with. Where a country is faced with a tendency to recurrent balance of payments difficulties which cannot be cured by any single once-for-all measure, tariff increases are unlikely to be the right policy since each increase raises the chance that the tariff will be above the optimum level.

25. Whereas for foreign countries as a whole the effects of expansion plus a rise in tariffs in the home country may be no worse than no expansion at all, this does not necessarily apply to any one foreign country. Even if the expanding country imposes a uniform tariff, this restricts imports from different foreign suppliers according to the various price elasticities of demand for the different goods; but the expansion in the demand for imports due to the increased level of activity depends on the income-elasticities of demand for different kinds of imports, or the input requirements of different industries in the case of imports of raw materials. Thus some foreign countries are likely to be injured by the combined income and tariff changes while others gain, even if the tariff itself is uniform. A more complex form of tariff gives further scope for differences in the relative position of different foreign suppliers; even if the demand for imports as a whole does not fall, the foreign countries which lose are left with a motive for retaliation.

26. Before leaving the balance of trade and national income motives for tariffs two final points need to be made. First, while a tariff may normally be expected to increase both the balance of trade and the national income,

this will not happen if foreign countries tend to react to any tendency for their balance of trade to worsen by taking steps to restrict their imports, whether by tariffs or otherwise. In this case the home country cannot hope to improve either its balance of trade or its level of income by tariff policy alone, since its exports fall *pari passu* with its imports. This does not, however, prevent the home country from using a combination of tariff policy and internal expansion of investment to raise its level of national income, though in this case the balance of trade will not be affected. If businessmen expect tariffs to increase prosperity, then whatever the objective justification for this belief, a tariff will tend to encourage investment and will thus naturally tend to be accompanied by some internal expansion in any case. The second point concerns export taxes; unless foreign demand for exports is inelastic, export taxes tend to worsen the balance of trade; thus the symmetry between export taxes and import duties does not apply in this section, and export taxes have accordingly been ignored.

27. The third major group of motives for tariffs concerns the desire to influence the composition of production or consumption, for reasons other than those directed purely at the redistribution of real incomes which have been analysed above. This may loosely be described as the protective motive for tariffs. As in the case of the income-distribution motive, the objectives of tariff policy in this case cannot be evaluated in purely economic terms. When the economist is told that a given tariff policy is intended to bring about some social or strategic objective, he should inquire whether the objective could be achieved more effectively or at lower cost by any other means; and if tariffs are indeed the best means of attaining it, the economist can try to show what the policy is costing in terms of forgone alternatives, so that governments and electors can make informed decisions as to whether the objectives are worth what they cost.

28. One possible motive for tariff protection of any industry is strategic, e.g. the desire to avoid dependence on foreign sources for supplies of essential materials or finished products which might be cut off either by the supplier or by a third party in times of hot or cold war. Protection in such a case is only worth while if the creation of capacity to grow, mine, or manufacture the goods concerned takes time; otherwise it would be wasteful not to make use of cheaper foreign supplies as long as they were available. When the goods concerned are indispensable and their manufacture requires the development of highly specific means of production, a prohibitive tariff, or the outright prohibition of imports may be more appropriate than a tariff which is low enough to admit some imports; but in the case of a class of broadly similar goods, produced by similar factors of production which can be moved fairly readily at least within their

industrial group, a tariff may provide a useful means of combining the encouragement of the growth of productive capacity within a group such as arable farming, or heavy engineering, while reducing the total cost of the policy in normal times by admitting imports of crops or machines of types where the country's cost-disadvantages are greatest.

29. One of the forms an economic critique of this type of policy can take is to try to assess the cost of alternatives such as stockpiling strategic commodities, or developing facilities for the production of substitutes for imports without actually using these till the need arises. It may also be questioned whether, in an era of rapid technical change, it is worth while incurring certain present costs for the sake of avoiding hypothetical future dangers. If the costs of avoiding the danger of shortages of particular goods are high, it might well be argued on economic grounds that it would be better to divert the resources used in protecting particular 'strategic' industries to increasing ordinary investment, research, and technical education, so as to increase the country's overall economic strength, and to rely on adaptability to cope with particular shortages as and when they arose. A similar point can be made against any policy of reducing imports generally in the interests of decreasing a country's vulnerability to attack on the means of transport. The long-run effects of halving a country's import requirements would be to halve the amount of shipping and port facilities available to handle the traffic, leaving no net gain in vulnerability to attacks on transport. A policy of 'mothballing' extra shipping would probably be better in this case.

30. Where the encouragement of the home production of a good for strategic reasons is the objective, it may still be doubted whether a tariff on imports is the best way of doing this. If home producers have higher costs than foreign suppliers, as must be the case if a tariff is necessary at all, subsidization of home production to enable it to compete with imports means that the consumers will get the good at a price based on foreign costs, whereas the taxation of imports to enable home producers to survive means that the consumers pay sufficient to cover the higher level of home costs. But if it is intended to carry protection to the point where the home producers supply any given fraction of the market, possibly all of it, at the lower price there will be a larger market, and more home production. As tariffs bring in revenue, whereas subsidies involve government expenditure, there is a temptation to solve the budgetary problem involved in the protection of home production by levying a tax on imports and using the proceeds to subsidize home production; but this need not be the optimum combination.

31. Thus far it has been assumed that the objectives of protection are strategic or social. Various arguments for protective tariffs have,

however, been put forward on grounds which are purely economic. It is only fair for the author to give warning at this point that in his opinion many of these arguments are often put forward with inadequate stress on the specific nature of the circumstances in which they are justified, and with inadequate recognition that even when they are theoretically valid their actual application tends to require information which practical policy-makers are unlikely to possess.

32. The first such argument to be considered is the argument that while the theory of comparative costs gives an analysis of the gains from trade and the arguments for free trade or low tariffs which is valid in conditions of perfect competition, this cannot be taken to apply in a country where there are varying degrees of monopoly in different sectors of the economy. The result of such monopolistic elements will be that under free trade too much of the community's productive resources will be induced to enter industries with low degrees of monopoly, while too little goes into those which are highly monopolistic. It is suggested, therefore, that tariffs should be put on the goods which compete with production in relatively monopolistic sectors of the economy, so that tariffs are used to correct the internal distortions. This policy looks somewhat odd, however, since it would involve increasing prices charged to consumers of goods whose prices are already relatively high, compared to marginal costs. Such a policy would thus tend to worsen the 'efficiency of consumption' even if it improved the allocative efficiency of the economic system on the production side. Even the expectation that it would improve allocative efficiency in production depends on a rather peculiar theory of the firm and of price-formation—namely, that there exist for each industry fixed 'degrees of monopoly', i.e. ratios of price to marginal cost, which are both arbitrary and constant. On a more commonsense analysis of monopoly one might suppose that a better reaction to the existence of varying degrees of monopoly in an economy was to try to use foreign competition to reduce the influence of monopoly where it was strongest.

33. Another case in which the existence of monopolistic influences is often held to justify tariffs is that of the imposition of special duties in order to counter 'dumping'. As dumping means that foreign countries are supplying imports cheaply, it is necessary to inquire why anybody should object to it. Where the objections are based on the effects of dumping on the balance of payments, or on the incomes of displaced high-cost home producers, the arguments for the imposition of tariffs fall into the classes we have already discussed. It is necessary to distinguish, however, between long-run and short-run dumping. If a foreign country becomes permanently prepared to supply cheap imports, this should normally be regarded as a favourable change in the world trading environ-

ment by the customers, and the question of whether or not the goods concerned are being sold at below the price the foreigner would have to charge if he followed what his competitors in the home country regard as a reasonable costing convention is irrelevant. Where the foreign supplier would be placed in a monopolistic position if he could once drive the home producers out of business, however, then the dumping may be merely a temporary stage in a price-war, and a country may be justified in refusing to allow a foreign supplier to use price-cutting to establish a monopoly. This may be argued on the grounds of the long-run effects of dumping on the terms of trade, which would of course worsen again when the foreign supplier settled down to exploit the monopoly position he had created, as well as on the grounds of the social costs of the unemployment which a temporary influx of dumped imports would entail. It should not be assumed, however, that all imports so cheap as to embarrass their home competitors are part of a foreign plot to corner the market, especially if there are several foreign suppliers. When low-cost imports are likely to be permanently available it is sensible for a country to adapt itself to this fact, as to any other feature of the rest of the world.

34. A further purely economic argument for a protective tariff is that it may be justified by the existence of increasing returns to scale in some industries. If prices were based on marginal costs it would be hard to see why increasing returns should give any distortions which a tariff policy could be required to correct; but where, for institutional reasons, prices covering average costs have to be charged it could be argued that the effect of free trade would be to prevent a country from taking the opportunity offered by decreasing costs in industries competitive with imports, so that free trade would prevent the attainment of the true optimum position of international specialization. This argument needs to be treated with some caution, however, for quite apart from the fact that transport costs give domestic industries a certain degree of natural protection anyway, if an import-competing industry has increasing returns to scale in one country, it will probably have them in the supplying country also. If, instead of country *A* being allowed to supply all other countries with a certain good from a very large low-cost industry, countries *B* to *Z* all insist on having their own industries, in the hopes of reaping the benefits of increasing returns to scale, the most likely result is higher costs and prices all round. Also, if a country has increasing returns in an export industry, then a restriction of the country's imports by tariffs tends ultimately to restrict its exports also, and the restriction is likely to fall particularly severely on decreasing cost industries, since lower sales beget higher costs and prices which lower sales still further.

35. It would appear, in fact, that the more cases of increasing returns

to scale there are in the world, the stronger are the arguments for free trade; the only plausible case for tariffs based on decreasing costs being that where a country could establish an industry capable of large-scale exports if it could only overcome the initial obstacles of high costs due to small size. Such a case is best dealt with under the infant industries argument for tariffs, to which we now turn. It is fairly common ground that new firms, especially in new industries, start life with sundry disadvantages; they have to train specialized labour and management, to learn new techniques by trial and error, to spend money on sales efforts to create or enter markets, and to cope with the technical diseconomies of small-scale production.

36. If such disadvantages apply to any new firm, however, why should it be held to be in the public interest to subsidize or protect new firms and industries in their early years? If an enterprise is soundly conceived and will ultimately be profitable, it could well be held that the losses made on early operations should be counted by the entrepreneurs as part of their capital costs, and that firms should only be started if the ultimate returns are expected to be sufficient to give an economic yield on the whole amount invested including these losses. If the returns are less than this, the resources used would be better employed in adding to the capacity of an existing firm. Tariff protection for an infant industry amounts to a subsidy for the producers to cover their early losses at the expense of the consumers. Even granted that this is the best form of subsidy, which as the tariff raises the price and restricts the size of the total market for the good concerned, may well be doubted, why should a government consider such a subsidy to be desirable? Arguments based on strategic needs, or a desire to redistribute incomes in favour of the group investing in the industry, fall under motives for tariffs already discussed.

37. There are, however, two further possible reasons for government willingness to protect a given infant industry. First, it may be that the government considers itself better able to forecast the future success of the industry, or to take a more long-sighted view about waiting for returns, than the available entrepreneurs, but does not want to run the industry itself. As a means of backing its economic judgement while avoiding the administrative burden of direct operation of the industry or possible political objections, subsidies for new firms may be justified. The government will in this case rely on recouping itself for the consumers' losses during the industry's infancy out of taxes on the ultimate profits.

38. The other possible reason for subsidizing infant industries which we must discuss is that the nature of the industry may be such that it will give rise to external economies, i.e. to benefits which do not accrue to the entrepreneurs. These might arise from the training of skilled labour, which

once trained would be able to command a competitively determined wage even from the firm which bore the expense of the training, or they might arise via the creation of consumers' surpluses which could not be tapped by discriminating pricing. Both these types of external economy raise the real income of the community as a whole, and thus its taxable capacity, so that the investment in the new firms may be worth while from the point of view of the whole community, or of the exchequer, even though they do not yield a private profit sufficient to pay the entrepreneur for the losses occurring during the early years of operation. It would thus appear that a rational case can sometimes be made for the encouragement of infant industries; but tariff protection may not be the best method; and the assessment by governments of future prospects of profits not apparent to the entrepreneurs who are actually running their firms, or the estimation of the size of future external economies, are processes which leave room for a lot of expensive mistakes.

39. The final class of motive for tariff policy that will be discussed here is the adoption of tariffs in order to reduce dependence on foreign trade in general, for the sake of promoting internal stability. It is notorious that the assumptions made in both the 'real' and monetary branches of the pure theory of international trade make no allowance for the problems of short-run instability. The theory of comparative costs, for example, works in terms of fully employed and perfectly mobile resources. If mobility is imperfect and prices and wages are rigid, then short-run disturbances are almost bound to cause periodic unemployment. To take another example, the theory of the adjustment of the balance of trade by means of devaluation works in terms of elasticities of supply and demand which imply long-run adjustment. If there are lags in the adjustment of supply and demand, however, the short-run elasticities may be so low that the conditions of exchange stability are not satisfied; or even if the trade balance moves in the right direction as a result of devaluation, the extent and frequency of changes in the exchange rate required under this method of adjustment may be such as to set up a tendency for the payments position to be dominated by speculative short-run capital movements.

40. In the light of such considerations it may well be argued that quite apart from the social costs of periodic unemployment, or alternating inflations and deflations of prices, the sheer economic costs of instability would be sufficient to justify a country in using tariffs to lower its dependence on trade with the rest of the world, or to justify an attempt by the use of discriminating tariffs to try to avoid trading too much with particularly unstable suppliers or customers. While it would be admitted that restrictions on trade might reduce the 'allocative efficiency' of the use of a country's productive resources to satisfy its needs in stable

circumstances, this cannot be concluded about the effects of restrictions on trade in circumstances in which prices in the rest of the world are fluctuating so much as to make it impossible to tell what pattern of production would best satisfy static welfare criteria. In this case any loss of allocative efficiency due to doing less trade could well be outweighed by increased allocative efficiency due to greater stability of internal prices and levels of demand which make possible more rational costing and investment decisions, quite apart from the advantage of an increased level of employment of productive factors.

41. Before deciding what degree of restriction of trade should be adopted on these grounds, it is necessary to consider both the costs of such a policy and the possible alternatives. If a country raises its tariff permanently in order to reduce its susceptibility to externally caused fluctuations, it may have to reduce its trade a great deal to have any marked effects in this direction; the more dependent on foreign trade it was originally, the greater this cut in trade is likely to be, and the greater the real sacrifice it is likely to entail. The higher the tariff, moreover, the greater the gain from trade at the margin on what trade remains; this raises the costs involved in using tariffs or direct controls over trade to counter such short-term fluctuations in the balance of payments as still remain. A country which imports nothing but 'essentials' is liable to find its short-term payments problems more embarrassing than a country which keeps up a margin of inessential imports in normal times, which can be cut relatively painlessly in a crisis.

42. The main alternative to stabilization via autarky is stabilization via holding reserves, both of foreign currency or goods, which can be allowed to vary in whatever manner is most appropriate to reduce the effects of external fluctuations on internal stability. This is not a costless policy, since it involves a country in expenditure on providing exports to earn its reserves, or producing commodities or mining gold for the stockpile. A country with adequate reserves of gold or foreign exchange, however, can afford to maintain domestic incomes at times of low foreign demand for its exports, thus both maintaining its imports and lowering its contribution to instability elsewhere; and a country with reserves of commodities can use them to offset the destabilizing effects of sudden shortages of vital imports on domestic prices and incomes. Export taxes variable over time are a further method which can be used to curb the inflationary effects on home incomes of booming world demand for a country's exports; the reserves thus acquired can be used to maintain incomes and consumption during any subsequent recession in world demand. Thus in considering how far countries would be well advised to sacrifice the current advantages of greater participation in international

trade for the sake of reducing their liability to externally caused fluctuations it is necessary to compare the costs and benefits of such a policy with the burden and benefits involved in investing the country's savings in foreign exchange or commodity reserves rather than goods which can be used for more immediately productive purposes.

43. The arguments by which actual tariff policies are justified may contain some elements other than those discussed above, but will be found in the main to consist of various combinations of those we have analysed. Arguments for tariffs tend also to be amalgams of the pointing out of genuine exceptions to over-simplified economic rules, of honest confusion over difficult concepts, and of rationalization of vested interests. There is no end to the variety of arguments which can be found to defend any given course of action by anybody who has once decided to pursue it. While there is not necessarily any one 'correct' method of classifying economic arguments, it is helpful in sorting out these various elements in any given argument for tariffs to have some comprehensive framework into which the various components of the argument for any particular tariff policy can be fitted; this article has attempted to assist in the attainment of clear thinking on tariffs by providing such a framework.

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